THE

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ELECTRICAL REVIEW.

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CO-OPERATION.

SEVERAL years ago suggestions were advanced for what was called "Co-operation" in the electrical industry. They received a certain amount of attention in our pages, and were for a few short weeks, or even longer, the theme of conversation, though looking back we must confess that neither the discussion nor the conversation seemed spontaneous, and it was not long before the initiators were the only ones who could manage to maintain enthusiasm for their cause, and in due course everybody else became weary of that blessed word "Co-operation," so that it was to them either anathema or the title of an amusing freak. Like many another proposal within our memory, it paled away before indifference, and died, and had no burial.

It is matter for regret when a great word is so used that it becomes common and bereft of its best meaning, so that it fails to conjure up before the mind all that it originally conveyed. It is so in respect to this word co-operation. It is so delightfully comprehensive that it will cover anything from a great world ideal down to the mutual business relations of a couple of burglars who share the spoils, and we have applied it to almost every effort of our day. Let the reader recall the variety of cases that have arisen in the electrical profession and industry where, when propositions have been made for dealing with particular conditions or situations, the very root idea has been co-operation.

We hazard an opinion that of the various co-operative electrical movements some have come to naught because their auspices, their time, and certain other important factors, were unpropitious. It may be that others have lapsed because it is but human that many members of the body corporate should have widely divergent interests, and that co-operation can only be harmoniously conducted when it limits itself to those matters where it can conduce to the good of the whole, and is ruthlessly harsh or unfair to none. But be the causes what they may, not many months elapse after the exhausting of one idea before another applying the broad principle of co-operation in some new way is produced. Indeed, since the outbreak of war that principle has been advocated persistently on every hand. As a nation we form one solid body co-operating toward one common end, the supersession of German militarism and barbarism. As a business people, we ought to be similarly engaged in connection with the supersession of German export trade. It is possible to spoil a case by having too large ideas, and perhaps some of the co-operative suggestions have not been acceptable on that account. But there is the general trade co-operation proposition, such as we have recently advocated, which is not too ambitious, and which ought to be carried into effect just as soon as ever possible.

We have urged electrical and allied manufacturing firms who are unable alone to tackle the new markets and the new lines of manufactures, to put their heads together for these express purposes, and there is a disposition on the part of a number of them to do so. We would that they were more numerous and more enthusiastic. We have advocated the combined consideration of the altered industrial position that confronts us by means of a Commission of the most capable representatives in different departments gathering under the motherly wing of the Government, and we firmly believe that something of this kind will have to come, and we hope that the Government will soon find time to attend to the matter. There are two other ways in which the

principle of co-operation is applicable to the present situation. One of these was referred to in the extremely thoughtful and timely address which Mr. Thomas Roles delivered as chairman of the Yorkshire Local Section of the I.E.E., of which we gave an abstract in our last issue. Mr. Roles was discussing some of the duties that devolve upon those of us who remain in civil life while our brothers are fighting in the trenches or are at work in camp, and one of his suggestions was that manufacturers and municipalities should work in co-operation during these critical times, as, if the former were to make a practice of notifying purchasers for which lines of goods orders were required to keep the works fully occupied, steps might be taken to assist them by placing orders for stock purposes. The speaker foresaw that there would be a boom in trade after the war, and the filling of orders of the above classes might enable the makers to deal more readily with the large demands that might be made upon them later. It would be extremely interesting to hear what response manufacturers have to make to this offer. Mr. Roles, though chief of an important municipal electrical undertaking, was probably not expressing the official views of the I.M.E.A., but we believe that he was speaking the mind of many another chief who is anxious to display a cordial spirit of co-operation with the manufacturers in these times of difficulty.

The I.M.E.A. has, as our pages have shown, been collecting information from its members concerning the extent to which they have in the past placed reliance upon foreign manufactures, and we are sure that they and the manufacturers' organisation can be trusted to take action along the lines advocated by Mr. Roles if such procedure is in the best interests of the industry. The proposition depends for its complete success upon a boom in the electrical trade as an assured certainty, as, if orders were executed in advance and the boom failed to mature, the depression in the curve would be aggravated.

Another of the local I.E.E. chairmen—Mr. P. P. Wheelwright has also drawn attention to the importance of keeping manufacturers' works employed and to the burden of responsibility that rests upon all purchasers who have orders to give out, to place them without delay. Mr. Wheelwright, like Mr. Roles, is also a borough electrical engineer, and he will know how far municipal men are inclined to indulge in capital expenditure at the present time, and how the Local Government Board and the Chancellor of the Exchequer will regard proposals for expending money in advance of actual needs.

Mr. Roles mentioned one other point which we may single out for comment. He said, as hundreds have said before him, that the first essential, if we were going to capture German trade, was to make a careful study of the requirements of purchasers abroad. Platitude? Yes, undoubtedly a platitude. But it is none the less necessary at this juncture on that account. It is one of those things that everybody gets into the way of saying. Would to Heaven that more of us would get down to the doing of it! The Colonies want us to meet their requirements from our own factories. Their hatred of everything German appears more and more pronounced every mail that comes in. After the war they won't take anything German if they can get its equivalent from England at a reasonable price. Our firms must have known something about the lines they have been losing to Germany in the competition of the last 10 years, and they cannot have been entirely ignorant of the reasons why these orders have passed them by. Their local branches will doubtless have kept them well informed on such matters, and will have more useful information filed away. How far local branches and local agents in the Colonial and foreign markets may be expected to report suitably upon the exact circumstances of their markets, it is not easy to say. Sometimes, no doubt, they will be able to afford a thoroughly capable and trustworthy report; but perhaps in other cases there may be an inclination to take too circumscribed and too superficial a view of things. But if firms' own representatives may seem from some standpoints not to be entirely the right kind of advisers required by the present situation, excellent as they may be for their own particular local operations, it is equally clear that the information vouchsafed by Consular officials and commercial attachés is still too general to entirely fill the bill for the electrical manufacturer. We do not desire in the least to depreciate the efforts either of the private firm's representative or of the Government Consul, but there seems to be a call for something more than these are able to tell us at the present time. We have read with profit many Government reports by general trade experts, but we have a very strong feeling that what would be of as great value to us as anything else just now would be reports from men of unquestionable electrical position and experience in each of the Colonies. We have asked for such reports before, but have not got them. Granted that if the British electrical manufacturer wants the business he ought himself to make the necessary efforts to secure it, but we take a long time to get to work either individually or co-operatively along those lines, and there is really no time to spare, and every electrical manufacturer cannot cover the world for himself. The American Consular authorities several years ago sent specialised experts to the different countries of Europe to report upon the possibilities of doing one particular kind of business. A certain representative knew the machine tool business from beginning to end, and he made it his business to worm his way into works and factories of all kinds in Italy, Turkey, and so on, and sent home most elaborate reports upon this one special line of manufactures. It seems to us that what is needed at the moment is for some organisation or other—even the Board of Trade—to dispatch experts who know the electrical and engineering business and are capable of making complete and reliable investigations.

The need is for the *specialised* trade representative in the interests of all in that trade, instead of a general representative who knows perhaps no trade at all to guide those in every trade. Now, is it reasonable to call upon the Board of Trade to dispatch such representatives at once? They have, we suppose, come practically to the end of the first phase of their campaign to assist us to capture German trade. Will the funds at their disposal admit of their doing immediately what we suggest? That matters require investigating in the interests of particular trades just now seems to us to be very clear.

The British electrical industry does not require merely a few old pieces of general reproof for having left this and that undone. These can all be turned up for reference and brought together in useful form for our instruction and edification; but no electrical or engineering specialist is required for making up that mixture. What we do want to know is such things as these:—

1. What electrical manufactures and materials have the Colonies bought from Germany?
2. Why have the purchasers favoured German electrical manufactures?
3. How far has price been a factor? Give us their prices against ours!
4. Has the German competition been due to a cheaper electrical article being supplied, or to dumping of good class manufactures?
5. Has the time of delivery been a matter in which British firms have been beaten?
6. What will be the electrical outlook and position in each Colony after the war?

We would have each of these items, and other besides, dealt with in the fullest possible manner by a man who appreciated exactly what it was that British electrical manufacturers needed to know in order that they might decide how to shape their course of action.

If the Board of Trade cannot undertake specialised investigations of this character, then perhaps our own electrical organisation can do it by a co-operative effort of the manufacturers, or if a sufficient number of them are represented in the Associations of a like class operating in the Colonies, perhaps, some mutual arrangement for the preparation of full and specialised material by the right men, or circles of men, can be made by cable. It is perfectly true that individual firms have divergent interests, but is it impracticable for them to make some grand united effort at this most exceptional time, in order that advantage may be taken of the prevailing opportunity? Certainly that blessed word Co-operation, with which we have opened this article, seems to call for reiteration at the end of it, for it can only be by co-operative effort on very broad lines that we can secure what awaits us.

Lead.

There has not been a great deal of feature in the lead market, but it is very satisfactory to be able to report that things in the metal trades generally are, by degrees, taking on a more normal appearance, and that this week trading has been resumed in the old way. Certainly, the market meets but once daily. This, however, is an important forward move, and it is only a matter of weeks at the utmost ere the usual two sessions a day are held. With things rapidly, therefore, getting back to the old way, confidence in the progressive nature of trade increases.

The home demand for lead has, on several occasions, been quite active, and, on the whole, a good deal of business has been done by the rollers and corroders, while there have been very large quantities taken for Russia. It is the Russian demand, indeed, which has been the great feature of the market for some weeks. Russia, like all the belligerent countries, has felt the need of preparing for a protracted and bitter campaign, and this has involved the laying in of enormous stocks of metals of all kinds. Of these lead and nickel have been the chief. The buying which has been going on, indeed, for shipment to our great ally has proved one of the chief supports of the market, and it seems to be pretty generally expected that the closing of navigation as regards Archangel, to which port all the supplies so far taken have been shipped, will bring about a weaker tone in the market. This, however, remains to be seen, for the production of lead in all parts has been cut down very sharply, and this must have an effect upon the general situation sooner or later. Not only has the Russian buying been a feature of the British market, but it has also been in evidence in the United States, and large quantities of metals have been dispatched from New York to Archangel while business is now being negotiated by way of Vladivostock. The cost of transport will, of course, be enormous, but this is a mere bagatelle when it comes to the smashing of the lunatic who has ruined some of the fairest areas of Europe, and has outraged every canon of decent living, besides wiping out of existence peaceful communities, under the conditions of the most revolting barbarism. Hence it is that high costs of carriage are not likely to check the influx into Russia of all the war material necessary.

The supplies coming in have been rather irregular, some weeks seeing hardly anything arriving, while, on the other hand, now and again a fair lot has come to hand. All the metal available has, however, been taken up without the least trouble, and what is more, lead has had to be withdrawn from the warehouses to meet the insistent demand for metal for shipment. As long as this sort of thing goes on there is no room for much drop in the price. America is a less pressing seller, and there are faint indications that by very slow degrees the trans-Atlantic industrial position is clearing up. Here there is no doubt things are steadying themselves, and the future is pretty hopeful now. As for Mexico, there is not the least improvement there; indeed, a further spell of anarchy, or something approaching it, seems to be in sight.

Ferro-Concrete Poles.

The article which we conclude in this issue, describing the Bangkok power station and system of the Government of Siam, by Mr. F. B. Shaw, contains many interesting and novel features; but none of these, we believe, will be so useful to the electrical engineer as the particulars given by the author regarding his method of manufacturing lattice poles of reinforced concrete. Solid and hollow poles are not uncommon, but we have never before been enabled to publish a description of lattice poles in this material. From the illustrations which accompany the article it will be seen that the appearance of the poles is greatly improved, and at the same time a reduction in weight is effected, together with a better distribution of the material, without loss of strength or increase of cost. This is in strict accordance with sound engineering practice, and carries with it the result so often observed—that the best engineering design goes hand in hand with the most æsthetic form. We commend this section of the article especially to the notice of engineers who are in a position to make use of overhead lines, as well as to the makers of poles, who by turning out ferro-concrete poles in large numbers should be able to produce them at low cost.

Railway Electrification.

The paper which Dr. H. F. Parshall read before the Institution of Civil Engineers on Tuesday last, on "The Economics of Electric Railway Distribution," is a notable contribution to the literature of the subject. It does not profess to discuss the merits of rival systems, nor does it deal with the operating costs of electric railways, except in so far as the distribution system is concerned, the equipment of the rolling stock being left out of consideration altogether; but it is a striking example of what Prof. Perry would call "the engineer's method of solving a mathematical problem." Reminding us in the official abstract (which we reproduce in this issue), but not in the paper itself, that Lord Kelvin formulated a law as to the economic design of conductors in transmission systems, the author points out that a similar treatment of the railway problem would involve so many independent variables that the mathematical expression from which the minimum cost of the distribution system might be deduced would be open to some suspicion; he has therefore adopted the plan of working out the cost for different distances between sub-stations and different voltages under various conditions, and embodying the results in curves, which show clearly the minimum values in each case. Other factors are, of course, considered, and the result is a paper comprising about 12 pages of text, 38 pages of tabular matter, and no fewer than 49 curve-diagrams—truly a unique production, representing a vast amount of labour. The information given as to the working of the Central London Railway has never, we believe, been previously published, and will be of great utility.

Dr. Parshall regards the paper as a labour-saving device, which can be utilised by the substitution of new data corresponding to any particular set of conditions, and claims for it great elasticity in this respect. Certainly the tables afford a very substantial basis upon which to found deductions, within the limits of their range, which is strictly confined to stated factors. Unfortunately, they take no account of the voltage drop in the line conductors, which, as the author admits, is often a controlling factor, irrespective of economic considerations. The tables, too, are based upon an average train service, whereas the normal conditions of traffic, at any rate on suburban railways, call for a greatly increased service at the rush hours; and the scheduled speed adopted (16 miles an hour) appears to be unnecessarily low.

We note that the author deals only with an overhead conductor throughout, for both D.C. and A.C. systems; and while he fully recognises the advantages of high voltages, he finds that little is to be gained in the case of D.C., by adopting a higher pressure than 2,400 volts.

The working results of the Central London Railway sub-stations show a diversity factor of the order of 1·4, and an average working efficiency of 90 per cent. The output from the generating station has remained fairly steady in the neighbourhood of $8\frac{1}{2}$ to $9\frac{1}{2}$ million units per half-year for 10 years, at a cost of about $\frac{1}{2}$d. per unit; the sub-station operating and repair charges per unit are steady at 0·04d., and the total sub-station charges are round about 0·18d. per unit, the total cost per unit delivered from the sub-stations for the last five years averaging about 0·72d. Dr. Parshall expressly avoids committing himself to any estimate of the costs that should nowadays be attained, but it is obvious that this figure is high compared with what may be expected with up-to-date plant. It should be borne in mind that the Central London plant was installed 14 years ago, and that the railway was only the third electric line in London; and the fact that there has never been a cable breakdown on the system speaks well for the care and skill with which the work was done.

CAN WE CAPTURE THE GERMAN TRADE?

By FRANK BROADBENT.

Although we did not take a hand in the European war for the purpose of capturing the German trade, it is hoped that this will be one of its results. And by German trade is meant not only the trade which Germany does in other countries, but in our own also. At the present time, even if it were not forbidden to trade with Germany, very few English people would voluntarily buy a German-made article, but it is freely and cheerily admitted that within a short time after the termination of the war we shall, as before, buy the cheapest, whether it be a German, Austrian or English product. We are an easy-going people, like most old folk, and we even laugh at our own weaknesses. We cannot expect a child to pay twopence for a toy just because it is English made, if he can get one, which looks the same, for a penny. Nor can we expect the father or mother of six to be any more patriotic when trying to make the most of every shilling. What is true in domestic lines may be equally true in the engineering market, and we should be foolish to rely overmuch upon the patriotism of the British buyer. A man may pay, say, 5 to 10 per cent. more for a British than for a German motor, but it is very doubtful if his patriotism would stand the strain of a 25 per cent. difference.

We have much to learn yet from German methods of manufacture. There is no doubt that they have applied scientific methods, not only to design, but also to works management; and those who have had opportunities of going through some of the leading electrical workshops in Germany must have been impressed with the splendid organisation, the machine-like order, and, not least, the respect for authority among all grades of employés. This latter may, or may not, be a result of military training, but whatever it is, it is a feature which is in marked contrast with the conditions prevailing in most British works.

We have been accustomed to regard this military discipline as destructive of initiative, but whilst this opinion may have some justification when applied to the rank and file of the army, who constitute the working classes, it cannot be justly applied to the official class, as their methods, both of warfare, and of manufacture and technical research, have shown. Whether we like it or not, we are indebted to Germany for many important inventions and new departures in electrical engineering, to say nothing of the gas, chemical, printing and other industries.

When three-phase work was first introduced we had to go to Germany for our motors, and for many years English firms would not make them.

"Let us wait," they said, "until there is a greater demand." Later on, when single-phase seemed likely to revive, it was left to Germany again to develop the repulsion motor, and to this day there is not among our large electrical manufacturers one that makes them. The great advance in arc lighting due to the introduction of the flame arc was largely due to German initiative, and still more recently we have been dependent upon the same source for the development of the metal-filament lamp.

In view of these facts, and many more might be cited, it is hardly fair of the British manufacturer to blame the purchaser if, having been compelled for a time to buy from an enterprising foreigner, he does not immediately transfer his trade to a tardy rival who, when the demand has been created, considers it worth his while to attempt to meet it, generally at a higher price.

Even now, when the German sources are dammed, it is a matter of great difficulty to induce a British manufacturer to make anything which involves stepping out of the rut which he has made for himself.

"We have no patterns for this;" "this is not quite in our line;" "we are now so full of orders that we could make no promise of delivery;" "this would involve our making new tools, for which we should have to charge you"; these are samples of the kind of reply sent to inquirers for goods which have hitherto been made in Germany in very large quantities.

If we are really in earnest about capturing the German trade, we shall have to study German methods, and find out why they are generally before us in invention and in initiating new and important advances in design; why they can copy our designs and manufacture them more cheaply; why their salesmen are better, and so on.

We generally attribute this to the more perfect scientific and technical training which their engineers receive; and if this be so, are our educational methods wrong, or is it that manufacturers do not appreciate the value of technical training?

It will be seen from the summary of the report of the Civil Engineers' Committee on Engineering Training that some manufacturers regard engineering graduates purely from the dividend-earning point of view, and others consider them absolutely useless. In a paper read before the A.I.E.E., Mr. A. J. Rowlands states that a chief engineer of a large corporation (himself a college man) recently said:—"I would rather have a man from the tool-room in the designing work than any college man. All they know is how to design a beam to support a fixed load a given number of feet from a wall; or other purely text-book problems. How the beam is to be held in the wall, or the load suspended from it, is beyond them." We do not know if the speaker was referring to American or Canadian colleges, but his attitude appears to represent fairly accurately the attitude of many of our manufacturers towards scientific education.

If this be a justifiable attitude, and if we admit that Germany's progress is largely due to her methods of scientific training, then there must be something wrong in our methods and not in scientific training *per se*.

Is it not time, therefore, that electrical manufacturers seriously considered this question from the point of view of its influence on manufacturing rather than wait for the Institution of Electrical Engineers to consider it from the point of view of qualification for membership?

RUSSIA AS A FIELD FOR BRITISH ELECTRICAL TRADE.

By G. W. de TUNZELMANN.

Recent articles in the Electrical Review have urged upon British electrical manufacturers the importance of immediate steps being taken to devise efficient schemes of co-operation, with a view to utilising to its utmost extent the unexampled opportunity now open to them of replacing Germany and Austria in the growing Russian market for electrical machinery and supplies of every description. M. Basile de Timiriazeff's letter to Prof. Pares at Petrograd was dealt with in a leaderette in the Review of November 6th. It is an express invitation to our manufacturers and merchants for immediate and effective aid in filling the immense gap in Russian industrial supply, which has been created by the war. And the invitation is official and authoritative; for its author, formerly Russian Minister of Commerce, is now the President of the Russo-British Chamber of Commerce in Petrograd, and in his letter he states that he sent a copy to Mr. Henry Cooke, who is the Commercial Attaché to the British Embassy in Petrograd, for communication, through the Board of Trade, to the British Chamber of Commerce.

M. Timiriazeff writes, with the authority of his official position and of his intimate knowledge of Russian industry, that "it is difficult for those not closely acquainted with Russian trade and industry to realise how enormous is the gap created by the almost wholesale withdrawal of German trade from Russia." And there is no section of Russian industry to which this weighty pronouncement is more completely applicable than the electrical industry.

Russia has hitherto been practically an unknown quantity—perhaps almost an unsuspected quantity—to our electrical manufacturers and merchants. Not so, however, to our

German competitors. The Russian electrical market is even now very extensive, and is steadily increasing, with every prospect of phenomenal development in the immediate future. Hitherto it has been almost entirely in the hands of the three German firms—Siemens & Halske, Schückert & Co., and the Allgemeine Elektricitäts Gesellschaft. The headquarters of the latter are in Warsaw, and those of the two former in Petrograd. Officially and ostensibly the Russian electrical industry has been, with few and quite insignificant exceptions, in the hands of these three great firms, and it might be supposed that competition between them would sometimes, at any rate, open the way for the entry of other firms, native or foreign, into the field. But any efforts made in this direction have proved unsuccessful, and I am positively assured by Russian merchants fully conversant with the local conditions, that, as far as outside competition is concerned, these three firms practically constitute an extremely efficient combine, working under far-reaching, and apparently in many cases very subtle, agreements.

The control of the Russian market by these firms has no doubt been largely obtained by the efficient organisation, minute attention to detail, and ready adaptability to the requirements of their customers, which are characteristic of German industry. But the consistent and unceasing support of the German Embassy in Petrograd, both in obtaining information and in the exertion of every available diplomatic influence, has certainly been an important factor.

Diplomatic support from our own Embassies has hitherto been very generally regarded by both merchants and manufacturers as quite unattainable, and no doubt much more might be done, and very probably will be done in the future, to give diplomatic aid to British traders. But far more than is generally considered possible may be effected if the matter be gone about in the right way. Those who have found the way and benefit therefrom are very naturally indisposed to be communicative to possible competitors. Moreover, in the way of obtaining local information, and making it generally available, much has been done by our Consular service during the last few years, and a very good example is afforded by a report from H.M. Consul-General at Moscow, which was dealt with in the Review of October 30th. In this report we find :—(1) Thoroughly sound advice with regard to propaganda in Russia ; (2) an indication of the way in which the co-operation of German firms has given them command of sufficient capital to meet purchasers in regard to terms of payment ; (3) valuable information of the methods by which German firms have met the conditions arising from the payment of Russian import duties on machinery by weight. This last item I may supplement by an example of special interest to intending importers of electrical supplies. The import duty on mounted incandescent lamps with carbon filaments is 30 roubles per pood of 36 lb., and, without mounting, 60 roubles per pood for carbon-filament lamps, and 65 roubles for lamps with metallic filaments. The German firms meet these conditions either by importing the lamps unmounted and mounting them in their Russian factories, or by importing lamps specially constructed with very light mounts. The work of their Russian factories is, as a matter of fact, mainly the assembling of imported parts, and the construction only of such items as cannot as profitably, or more profitably, be imported.

At the present time, there is a great demand for 120-volt metallic-filament lamps and for low-voltage lamps, such as are used in pocket lanterns, and also for other electrical supplies more easily obtainable just now, such as flexible for incandescent wiring. Such business has recently been very greatly hampered by the recently prevailing abnormal rate of exchange of 120 roubles per £10, in place of the normal value of about 95, which has been equivalent to an additional heavy import duty, as far as the purchaser is concerned. I learn, however, from an authoritative Russian official source, that this difficulty is now removed.

There is a wide field now open for the supply of electric light and power, both for large plants and for innumerable small isolated ones. For these small plants and for some of the larger ones, cheapness is a primary consideration, and the German firms have successfully devoted their attention to the attainment of this object by plainness of construction without sacrifice of durability and efficiency. In many districts oil engines will have to be employed as prime movers.

A concession for an electric supply to Petrograd, from the Roshiala rapids in Finland, estimated to be capable of delivering from 300,000 to 400,000 H.P. was granted in the autumn of 1912, and the future development of water power electric supply in other districts is contemplated by the Russian Government. Extensive Government contracts for electric railway plant may be expected after the termination of the war.

British traders should not fail to note M. Timiriazeff's insistance on the urgency of the situation created by the immediate annulment of the Commercial Treaties of Russia with Germany and Austro-Hungary. The field has been cleared and is waiting to be tilled—now, and not merely when the war is over. And our traders should be encouraged to make immediate response to the invitation by his further assurance that Russia is seeking to provide "a permanent basis for normal times," when, "at the end of the war it will be necessary to revise and establish on a new basis the whole international commercial policy of Russia."

German traders secured the trade largely through the influence brought to bear by the German Government, but also because they took infinite trouble, first, in ascertaining the requirements of the Russian people ; and, secondly, in meeting those requirements at reasonably low prices. Yet their uncouth manners, and a psychology utterly antagonistic to that of the Russian, have made them personally disliked, so that for years past Russians would have preferred to do business with Englishmen, whom they like. This dislike for the German has now developed into a deep loathing and bitter contempt which the ordinary stay-at-home Briton would entirely fail to understand, were it not that he is now beginning to some extent to share it. And Russian and Briton are now cementing with their blood their brotherhood in arms for the maintenance of Christian civilisation against a decadent pagan barbarism.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Nite Lite" Transformer Lamp.

The General Electric Co. (U.S.A.) has introduced a miniature transformer contained in a polished brass shell coupled to a miniature Mazda lamp to meet the convenience of those who desire a low burning lamp for all-night service. It is designed to operate on any A.C. circuit of from 100 to 125 volts, and 50 to 140 cycles, and is made to screw into the standard Edison lamp socket. The normal supply voltage is reduced to 6 or 7 volts, and the lamp receptacle fits a Mazda automobile lamp of 2 C.P. At the average cost of electricity a "Nite Lite" transformer will burn for 10 hours at a total cost of less than $\frac{1}{10}$ths of a cent (according to the *Journal of Electricity, Power and Gas*).

Continuity Grip Fittings.

Messrs. Credenda Conduits Co., Ltd., are introducing to users of conduit their "Spring" grip continuity fitting, which has received the approval of the electrical authorities and first-class insurance companies. The system is a substitute for screw contact

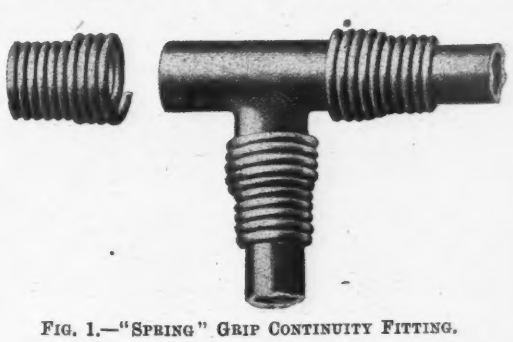


Fig. 1.—"Spring" Grip Continuity Fitting.

systems, and is claimed to overcome the difficulty of leaving continuity to the labourer or his assistant. Fig. 1 shows the arrangement ; the conduit is forced home or withdrawn by a

turning movement, which tends temporarily to open the coil, and if tight fitting, a little oil or grease will make the operation easy.

We gather that the system can be erected in a little under half the time taken to erect one of the best screw device systems on the market.

The spring grip cleans the conduit of enamel, as shown in fig. 2, and thus it makes good contact as it enters the fitting or grip, and the latter allows for variation in size of conduit.

Fig. 2.—Conduit Fitting Scraped by Grip.

There is a point contact at either end of the grip, which cuts well into the metal of the fitting, and the cutting edges and general stability of the grip are secured by using the finest quality carbon steel, properly hardened and tempered; no tools are required to fit up this system, which is fully explained in List D.

Boiler-Plate Cubicle Switchboards.

A recent example of a large amount of switchgear compressed into a small space is a boiler-plate cubicle for A.C. work supplied by the General Electric Co., Ltd., of Witton, Birmingham, to an important firm in the Midlands, for whose works the G.E.C. are undertaking the complete electrification. The firm takes extremely great pride in its works and insists upon the highest quality gear being installed throughout. This and a sister board had to be placed in a very cramped position, the dimensions being so small that two panels had to be mounted directly over each other. The board being composed of boiler-plate cubicles, it was necessary to provide inspection doors, which not only gave a good view of the interior, but enabled work to be carried out inside the board should it become necessary. Although many of the doors had of necessity to be utilised to accommodate the instruments, it is not anticipated that the opening and closing of the doors, which will not be of great frequency, will result in any damage to the instruments. In the interior of the board, too, the whole of the gear had to be compressed to the utmost. The whole of the board was of G.E.C. construction.

C. and I. Electric Hoist.

Messrs. Campbell & Isherwood, Ltd., of Raleigh Street Works, Bootle, have recently introduced a new type of electric winch for marine and general use, for which patents have been applied for.

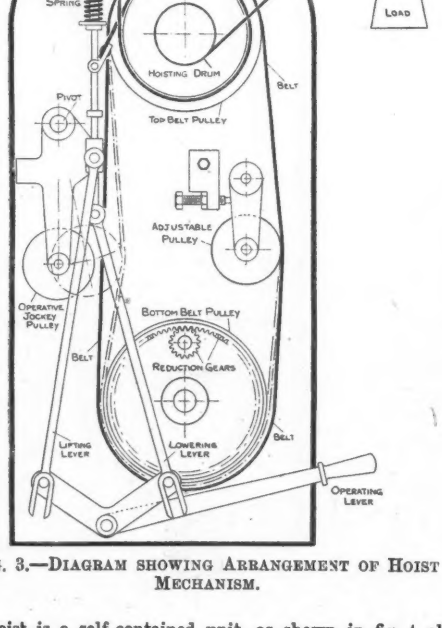


Fig. 3.—Diagram showing Arrangement of Hoist Mechanism.

The hoist is a self-contained unit, as shown in fig. 4, all the working parts being enclosed in a cast-iron case, only the winding drum and operating lever being outside. The case can be arranged for bolting to either the wall or floor. Fig. 3 shows the arrangement of the hoist diagrammatically. The hoist works on the principle of a slack belt, which normally remains stationary on the pulley to be driven, and is set in motion to lift the load by means of a pivoted jockey pulley, which brings it into driving contact with a continuously driven pulley. The bottom belt pulley is continuously driven by a motor through a pinion and internal gear. The hoisting drum is keyed to the top shaft, which also carries the belt pulley and hand-brake drum; the belt hangs slack when not hoisting and the spring of the handbrake keeps the latter applied with the operating lever in the neutral position. Depressing the lever releases the brake and tightens the belt; raising the lever beyond the neutral position allows the load to fall at a speed governed by a centrifugal brake (not shown in the diagram). Either A.C. or D.C. motors, with ball bearings are fitted, similar bearings being used throughout. The gears are machine cut and the hoists have been proportioned for rough handling. Three sizes are built, for lifting 1½, 3 and 5 cwt., all at a speed of about 180 ft. per min.

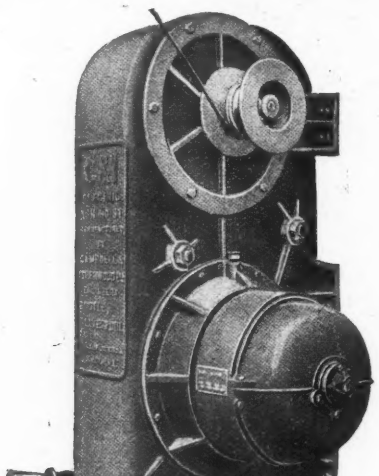


Fig. 4.—C. & I. Electric Hoist.

Two winding drums can be supplied; 50 ft. of wire rope with hook and weight, and swivelling guide pulley are provided with each hoist.

G.E.C. Main Regulators.

For the regulation of the exciting current of large generators, two forms of regulators are in vogue, the first frequently known as the rectangular type, and the second the face-plate or circular type. The illustration shows the latest form of rectangular type regulator constructed by the General Electric Co, of Witton, Birmingham. In this regulator the resistance is composed of resistance strip, though when the characteristics of the generator

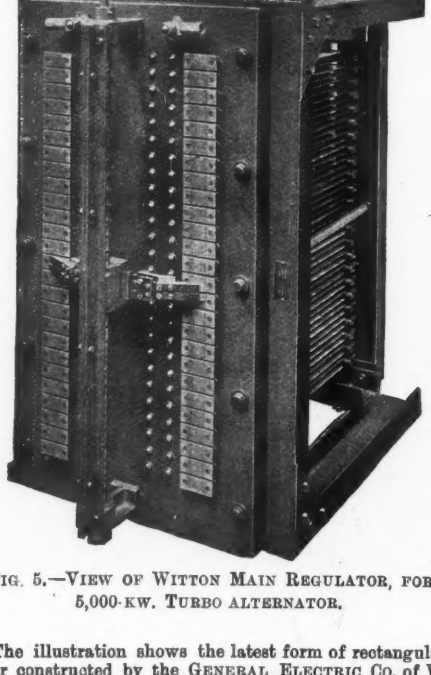


Fig. 5.—View of Witton Main Regulator, for 5,000-kw. Turbo alternator.

permit "unit" type wire resistances are employed. The expansion and contraction of the strip brings into play large forces which frequently buckle the framework of the regulator. To take these stresses, the framework is built up of mild channel steel, braced and supported at every point where the stresses are likely to be particularly heavy. A further source of trouble has been the sag of the strip, and means have to be provided for adjusting the strip tension; in this case individual adjustment is provided to each turn of the strip, instead of only one adjustment for the whole length. In this way the tension on any turn of the strip can be rapidly adjusted in a few seconds.

These regulators have of course to carry heavy currents and the design of the contact brushes is a matter of importance. Steps have been taken in the present design to give the brush self-aligning characteristics, and by means of two sets of screws the pressure on the contact and the position of the contact brushes can be adjusted independently. Fig. 5 shows a regulator for a 5,000-KW. Witton turbo-alternator.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Trading with the Enemy.

Referring to your correspondent's letter inserted in last week's REVIEW, dated November 13th (under "War Items"), as to payments due by English traders to German or Austrian merchants or manufacturers, my own view is that these accounts should be paid where the indebtedness is not disputed, and my suggestion is that payment should be into Court or to Receiver to be appointed, and paid out when the war is over, otherwise the firms of the enemy have no security against failures of their debtor in the meantime.

I consider that no honest trader should absolutely refuse to pay the enemy their just dues.

G. Weston.

London, *November 14th*, 1914.

About Electric Radiators.

We are somewhat surprised and amused to see from Mr. Sharp's letter referring to Messrs. Belling's electric fire advertisement that he is of the opinion that Messrs. Belling were aiming at the Jackson radiator, because we had the impression that our fire was referred to, and we are now wondering how many other people have tried "the fit of the cap." We must confess that after trying it we find it a misfit.

It is true our fire is concentrated, but we maintain it is not "too highly concentrated," and by concentration we are able to insure longer life.

Similarly, we claim that our fire is not "two much boxed up," although we intentionally enclose it to shield the heating elements from air currents and thus prevent oxidation.

As for being "too fiercely radiant," we should not have thought it possible to err in this direction, and we intend to do our utmost to make our fires more and more fiercely radiant without reducing their reliability.

We cannot understand why a "too much boxed up fire" should also be held guilty of burning dust. Surely the greatest dust burner is the greatest producer of "rising hot air circulation," for the dust is suspended in the air, therefore—more air, more dust. We would add that the bigger the proportion of radiant heat the smaller the heat loss in the room when the door is opened.

Mr. Sharp has already commented on the "radiant heat in every direction." We think perhaps there may be some mistake in Messrs. Belling's advertisement, because we note that the arrows indicating the direction all point the same way.

Ferranti, Ltd.

London, W.C., *November 17th*, 1914.

Your correspondents, the Jackson Electric Stove Co., state that Messrs. Belling refer to radiant heat as tending to dry up the moisture in the air.

May I suggest that radiant heat of high temperature only is responsible for any distress experienced in this connection—combined with an absence of air in motion.

Whilst elements of relatively low temperature are desirable, the public prefer high temperature elements, presumably because they look more "cheery." An evaporating dish will, however, be found quite effective in counteracting this effect.

The term radiant heat has, I notice in recent correspondence, been confused with luminous heat. May I remind those not fully conversant with physics that whether the elements are run at black heat or bright red heat, in both cases they transmit heat rays which are virtually all radiant—wholly so with black heat, and in the case of bright red heat operating at 1,000° F.—1,200° F. almost wholly, the latter representing 98·5 obscure or dark rays, plus 1·5 luminous rays. This may be proved by blocking all luminous rays by the interposition of a suitable filtering medium (such as bisulphide of carbon), when it will be found possible to toast equally well, using dark rays only.

Such rays exhibit broadly similar characteristics to light rays, in so far that they proceed in straight lines and can be converged and even focused if desired. It is questionable whether such luminous heat rays possess any virtue other than that of attaining more rapidly a high temperature—at least our leading text-books do not favour such a supposition.

F. Barron,

Electric heating engineer (*late Carron Co.*).

London, S.W., *November 16th*, 1914.

LEGAL.

GOODBODY *v.* POPLAR CORPORATION.

MR. JUSTICE DARLING and Mr. Justice Sankey, sitting as a Divisional Court of King's Bench, on November 12th, heard an appeal from a decision given by Judge Bray in the Bow County Court in an action against the Poplar Corporation by a Mr. Goodbody, who claimed damages for personal injury occasioned by an explosion of gas in an electric chamber beneath the footway.

MR. VACHELL, K.C., stating the case for the appellant, said that the action in the County Court was tried by a jury who assessed the damages in favour of the plaintiff at £35, but they answered a number of questions put to them by the judge in favour of the Corporation, for whom the judge entered judgment. He (Mr. Vachell) contended that, notwithstanding the answers of the jury, judgment ought to have been entered for the plaintiff for the amount of damages assessed by the jury. In September of last year the plaintiff was walking along the footpath of Bow Common Lane when there was an explosion in an electrical chamber under the pavement. It seemed that gas had escaped and accumulated in the chamber, where it was ignited by an electric spark, with the result that the cover of the chamber was blown up, causing the injury to the plaintiff in respect of which he sued. In reply to questions left to them by the judge, the jury found that the chamber did not constitute a nuisance, and that the Corporation had not been guilty of negligence. After hearing legal argument, Judge Bray held that he was bound by the findings of the jury, and gave judgment for the defendant Corporation. It was against his so entering judgment that the plaintiff now appealed. Counsel submitted that negligence did not matter, and that the Court was not concerned with the question of whether the chamber was a nuisance or not. He contended that according to recently-decided cases the Corporation had established "a dangerous thing" on the highway; they had control of it, and if in consequence of anything that happened, even if it was the act of a third party, the "dangerous thing" caused injury to anyone, liability would follow as a matter of course.

Without calling upon Mr. Thorn Drury, who appeared for the respondents, their LORDSHIPS dismissed the appeal, with costs.

MR. JUSTICE DARLING said it was not contended for a moment that the mere destruction of an electric fuse and the escape of a spark alone caused the injury to the plaintiff. No injury would have resulted had there been no gas in the chamber which the defendants had not put there and which they could not have kept out. The gas had escaped from a main over which the Corporation had no control.

MR. JUSTICE SANKEY, concurring, said the plaintiff might have joined the Gas Co. as defendants.

RONEO, LTD., *v.* W. H. MULLER & CO. (LONDON), LTD.

IN the City of London Court, on Monday, before Judge Rentoul, K.C., plaintiffs made a claim against defendants, of Bury Street, E.C., to recover £40 10s. for an electric Roneophone, an electric reproducing machine and 36 disks, at 25s. per dozen, supplied to their order. Mr. Douglas Hogg appeared for the plaintiffs, and Mr. Jowitt for the defendants.

Plaintiffs' case was that they sent a representative to the defendants and submitted their electric Roneophone. It was an electric machine which acted on the principle of the gramophone, as it took down letters to dictation, and then the disk could be sent out to a typist, who typed out the letter, saving the necessity of using shorthand. A great saving of time was effected, and the work was done more efficiently. Defendants first had a machine on trial, and when that had been approved two others and some disks were ordered. One advantage of the latter was that they could be used many times over, as the record could be shaved off when the letter had been typed. Defendants subsequently said that the machines were not satisfactory. They required a little experience to speak into them and to get the best result. There was another machine, the Parlograph, of German manufacture, and a little cheaper, and defendants seemed to prefer that, which accounted for their rejecting the plaintiffs' Roneophone. Plaintiffs called evidence to show that the machines were satisfactory, and a demonstration was given in Court, the Judge testing it personally.

Defendants' witness said that the electrical plug fired on one occasion and they could not get the machine to go properly.

Plaintiffs said it was practically impossible for the plug to fuse because the wires were all insulated.

JUDGE RENTOUL after the test said the machine would be of no use to him, because when he put the ear-pieces in his ear he could not hear all the dictation. He heard a great many of the words

distinctly, but he could not have taken them down. He had tried talking machines and heard perfectly.

Defendants' typist said he had a shock when using the machine.

Judge Rentoul said he would like to hear the Parlograph used in Court, but it was stated that the voltage necessary was 220.

Mr. Hogg said that 900 of their machines were in use in London with approval.

Mr. Jowitt said he did not allege that all plaintiffs' machines were wrong, but only the two in dispute.

Judge Rentoul suggested that the case should be adjourned for further trials, and that was done.

The National Electric Construction Co., Ltd.

Mr. Justice Neville, on March 13th, heard a petition by this company for the sanction of the Court to special resolutions passed for the reduction of its capital.

Mr. H. E. Wright, in support of the petition, stated the proposal was to reduce the capital by £125,000, which had been lost, or was unrepresented by available assets. The company, as its name implied, was formed for the purpose of carrying out electrical construction work. Originally they were largely interested in a system known as free wiring, a principle which was now of less importance than it was once. The original capital of the company was £250,000 divided into 250,000 shares of £1 each, and of these 170,000 had been issued. A large number of the shares were issued as fully paid up, but all were issued under properly registered contracts, about which there was no question. The resolutions that had been passed proposed that the capital of the company should be reduced from £250,000 to £125 000 divided into the same number of shares of 10s. each. It was proposed to write off 10s. per share from each of the 170,000 issued, and reduce the 18,000 unissued shares to shares of 10s.

His Lordship asked whether the loss had been strictly proved.

Mr. Wright said there was exhaustive evidence of loss.

There was no opposition to the petition, and his Lordship sanctioned the reduction as proposed, directing the words "and reduced" to be used as part of the company's title for one month.

Action Against Tramway Contractors.

In the First Division of the Court of Session, judgment has been given in a reclaiming note in the action by a Glasgow manufacturer against the British Thomson-Houston Co., Ltd., Glasgow, and the District Committee of the County Council of Lanark. The pursuer, who sued for £500 damages, stated that while returning from Glasgow with a motor-cycle he passed through Bellshill, and at a bend in the Old Edinburgh Road, and near the electrical power station there, he ran into a heap of road metal and tar macadam which was encroaching on the surface of the roadway for a distance of about 6 ft., and about 3 ft. in height, with the result that he sustained serious injuries. The pursuer alleged that the heap of metal was unlit, unfenced, and unwatched, and he had no warning that such an obstruction was there. The British Thomson-Houston Co., Ltd., stated that in laying a tramway in the neighbourhood they were instructed by the District Committee, with whom they were contractors, to place the road metal and tar macadam on the grass margin of the road in question, but all deposits were made under the supervision of the servants of the District Committee. The Committee founded on their contract with the other defenders, and stated that the other defenders did not, in terms of their contract, deposit the heap of road metal on the grass margin, but deposited it on the roadway, and accordingly they were not responsible for the fault of their contractors. Lord Dewar, in the Outer House, approved of an issue for the trial of the action by jury. The First Division have now adhered to the judgment of the Lord Ordinary, with expenses to the respondent.

Cunningham, Ltd.

A petition by W. T. Henley's Telegraph Works Co., Ltd., for the compulsory winding up of Cunningham, Ltd., was before Mr. Justice Neville, in the Companies' Court, on Tuesday, November 17th. It was stated that it would be necessary to amend the petition, and for that purpose it was suggested that the hearing should stand over until next sittings. Mr. Wilkinson, for the company, did not object, and the matter was adjourned until the first petition day after Christmas, the company giving the usual undertaking not to go into voluntary liquidation in the meantime.

Read v. The Stella Conduit Co

In the Chancery Division on Tuesday, Mr. Justice Joyce delivered a considered judgment in this case, it being an action brought by Mr. Albert Edward Read and Mrs. Ellen Brooks for an injunction to restrain the Stella Conduit Co., of Highfield Works, Bilston, Staffs., from infringing the plantiffs' Letters Patent No. 18 375 of 1905 and No. 21,604 of 1906, for iron tubular elbows or couplings for connecting the ends of tubings and improvements in fittings for electrical conduits. Plaintiff also claimed damages. The main defence was that there was no subject-matter in the plaintiffs' Letters Patent.

Mr. Justice Joyce, in the course of his judgment, said that instead of covering wires for electric lighting with wooden casing a better, and, as he understood, a newer method was to enclose and carry the wires through metal tubes or conduits. This casing was formed of various lengths of tubing connected together by screwing one end into or over the end of the other length of tubing. Specimens of parts of these tubular electric conduits had been shown to him. Some of the lengths were shorter than others, and some were bent for the purpose of turning corners, and others in the form of a tee. Some were made with the screw thread outside at both ends, and some shown to him had the screw thread inside at both ends. What he had described appeared to be the usual mode of connecting tubes together and the usual way of forming a conduit of electric wires. His Lordship then described the way in which the frames of bicycles are joined or connected together, and said that that device was well known at the date of the plaintiffs' letters patent, viz, the ordinary bicycle grip and socket. In his opinion, there was no subject matter in the plaintiffs' alleged invention, and, therefore, their letters patent were invalid for want of subject matter. The action would be dismissed, with costs.

A stay of execution was granted for three weeks with a view to the plaintiffs considering whether they would take the case to the Court of Appeal.

WAR ITEMS.

Oldham Corporation and its Contracts.—What appears to be the end of the somewhat protracted discussions which have taken place at Oldham regarding a contract which the Corporation have with the Tudor Accumulator Co. was reached last week, when the matter was again before the T.C. The Electrical Committee, as reported in our columns, had decided that the firm should be requested to proceed with the work on giving an undertaking that no part of the money should be remitted to Germany during the continuance of war.—Councillor F. Brierly said that something like £47,000 of the £50,000 capital in the Tudor Co. was held by Germans, and he objected to the Corporation paying accounts to the firm and providing bullets to shoot British soldiers. He objected to the contract, and said the stipulation laid down by the Committee that no money should be remitted to Germany during the war was "bosh."—Councillor Dixon moved as an amendment to the acceptance of the minutes that the minutes pass with the exception of the contract referred to.—Councillor Sugden, who seconded the amendment, said that if certain material had been made under the contract they should pay for that but for no more.—Alderman Isherwood, supporting, urged for a definite and consistent policy on the part of all Corporation committees. The Tramways Committee, he said, had cancelled all the work that the company referred to was doing, and there should be consistency.—Councillor Turner said they were talking too much to the gallery. Whilst agreeing that they ought not to enter into fresh contracts he thought they should carry out the contracts on which they had already entered.—Councillor Frith said the decision of the Electrical Committee was almost unanimous. The Corporation had entered into a contract, and he urged that they should stick by it. Newspapers had only raised the outcry against German firms for political capital, and were playing to the gallery just as some individuals were now doing. He was bitter against the Germans, but the contract had been given, and they could not find a company which did such work that had no connection with Germany. It was "tommy-rot" to say that the money would be going to provide bullets with which to shoot British soldiers. The whole of the labour and material used would be English. If the contract was cancelled, Dukinfield workmen would be out of employment so far as that particular contract was concerned.—Councillor Schofield threw out the suggestion that the Committee should arrange to withhold 10 or 15 per cent. of the contract price until after the war.—Councillor C. Hardman (Chairman of the Electrical Committee) said the whole question had been very carefully considered. At the end of August the Committee passed a resolution relating to the contract without the slightest thought that the company had any association with Germany. Then they made inquiry and found that a large proportion of the capital was held by Germans. The contract was given at the end of August. They were not trading with an enemy country. He thought every member of the Council would be willing to follow Lord Kitchener. Well, Lord Kitchener had given a contract to the firm in August, and another in October. Would he provide bullets for the Germans to shoot at our soldiers? Nothing could be more ludicrous. The India Office gave the firm contracts in September and in October. Having this information, he suggested that the mover and the seconder of the amendment might be patriotic enough to withdraw their amendment. He would be willing to accept the suggestion as to making an endeavour to retain a small percentage of the account, equivalent to interest, until after the war. On October 10th, the Electrical Committee got an assurance from the firm that there had been no communication from or with the directors in Berlin, that there would not be any, and that no money whatever would be sent to Germany during the war.—The amendment was defeated by a big majority.—A contract for the supply of cable from a certain firm was withdrawn, but Councillor Hardman said the cause of the withdrawal had nothing to do with the nationality of the firm.

After the War.—The Right Hon. Lord Inchcape, the President of the Institute of Bankers, in delivering his inaugural address last week, said that with the continent of Europe practically closed to international commerce, there must be a great shrinkage in most departments of trade so long as the war lasts. There will be a shrinkage in the consumption of this country also, which will adversely reflect upon most branches of trade. When the war is over the taxation which will be a burden upon Europe for many years to come, the enormous destruction of property on the Continent, the waste in non-productive expenditure entailed by the war, will set back international trade for some years. It may be some years before we see a return of the wave of prosperity which we have recently enjoyed, but we shall not repine if we have to shed some of that extravagance and luxury which has shown itself perhaps too freely in the past few years, if we are able to retain that place in the world which makes for culture, civilisation, peace and goodwill. —At the meeting of the Council of the London Chamber of Commerce last week, according to the "Financial Times," a resolution emanating from the manufacturers' section was adopted expressing the opinion that the Government should give some assurance that manufacturers will be assisted to carry on freshly established industries on the termination of the war, and that, apart from other measures, national interests might be advanced by giving to our Allies some sort of preference as regards goods in the production of which there were not the same facilities in this country as in the Allied countries.

Northampton Tramway Managership.—The management of the Northampton tramway undertaking is being considered by a special committee of the Tramway Committee, who are to report to a full meeting of the Committee next Monday. A certain section of the Committee favour the reinstatement of Mr. J. Gottschalk, who was dismissed owing to his German nationality, and they suggest that Mr. G. E. Mawby, a former chairman of the Tramways Committee, should temporarily manage the undertaking, but this does not meet with universal approval. The heads of the various departments have been made responsible for the management of their departments pending the appointment of a general manager. Mr. Gottschalk has written to the Tramways Committee thanking them for the kindness shown him at all times. There has been an agitation in the town for the removal of the German manager's name from the cars, and the Committee have promised that this shall be immediately effected. Stamp-paper has been placed over the name upon notices in the cars by persons who moved strenuously for Mr. Gottschalk's dismissal.

B.E.F. Men with the Forces.—With a view to stimulating enlistment, the periodical report of the British Electrical Federation Mutual Aid Fund urges all eligible employés of its fifty tramway, omnibus and electrical undertakings to join the Army, and assures them that their places will be kept open and their dependents properly supported in their absence. Pending the decision of the Government on the question of increased pensions, allowances to dependents of those employés who have lost their lives in action are being continued. Although the fund is subjected to the strain of departing subscribers and increasing dependents it is in a sound condition, with a balance of £622 in hand. Out of 7,432 men, 757 have gone to the war. These figures apply to all the companies of the Federation with the exception of the Metropolitan group, viz.: The Metropolitan Electric Tramways Co. and its allied companies, for the benefit of whose employés the T.O.T. (Tramway, Omnibus, Tube) Mutual Aid Fund has been established.

Board of Trade Reports: Russia.—The British Vice-Consul at Ekaterinburg reports that the cessation of Germany's import trade with Russia is already beginning to make itself felt in the Ural district, and enquiries are being made at the Vice-Consulate as to the possibility of substituting by United Kingdom manufacturers those goods which were formerly imported from Germany in large quantities. As regards machinery, the chief goods in demand are the following: Electrical plant of all kinds, including dynamos, turbines, and electrical fittings of every description, locomotives, mining machinery, wood-working machinery, and agricultural machinery.—"Board of Trade Journal."

Report No. 92 of the Board of Trade campaign series deals with German and Austro-Hungarian plate and sheet glass trade. Report No. 93 deals with animal-drawn vehicles.

Engineering Units of Royal Naval Division.—In the House of Commons on Monday Sir William Bull asked the First Lord of the Admiralty if the Institutions of Civil, Electrical and Mechanical Engineers were invited to obtain picked men for the divisional engineering units and signal company of the Royal Naval Division recently formed, and if a number of labourers and other recruits without engineering knowledge were afterwards added to these units on the same terms of enlistment.—Dr. Macnamara replied that the institutions were invited as stated to provide a considerable number of recruits, but owing to the nature of the work required of the engineer company, which included manual and skilled labour and also the care of horses, other recruits whose qualifications were suitable had to be taken.

Belgian Industries.—According to a financial daily, a meeting of the Commercial Committee was held last week at the House of Commons. M. Pollet, the Consul-General of Belgium, who attended the meeting, which considered what steps should be taken to co-operate in introducing Belgian industries in this country, said that there were several trades and interests affected in consequence of the war, and this was the time to secure for the allied countries a trade which, up till then, was exclusively German. Speeches on this point by members indicated a desire of co-operation in endeavouring to establish in this country factories and workshops to manufacture articles monopolised previously by Germany.

Appeal.—The Vegetable Products Committee (Alderman's House, Alderman's Walk, London, E.C.) has issued an appeal, signed by Lord Charles Beresford, the president, asking for financial assistance to enable it to continue sending fresh fruit and vegetables to the Fleet, especially to the torpedo boats and destroyers, submarines, and mine-sweeping trawlers, which are badly in need of such provisions.

Nothing German at Halifax.—Instructions have been given by the Halifax Tramways Committee to their manager not to purchase any more goods from German sources.

Metal Trade.—The "Times" correspondent at Melbourne says:—"Mr. Hughes, the Attorney-General, states that inquiries show the control of the metal market has long been to a great extent in German hands. The same control has still continued since the war began, and a great part of the trade profits are finding their way into German pockets, though steps have been taken to prevent metals useful to belligerents from reaching enemy countries."

Russian Supplies.—The Russian section of the International Commission of Supplies (192, Cromwell Road, S.W.) expresses its regret that it is unable to deal with the great number of communications from merchants, contractors, and others offering to contract for supplies. All communications, however, are filed for reference, and will receive due consideration when the supplies are required.—The "Times."

Aberdeen Tramwaymen.—Sixty-eight of the Aberdeen tramwaymen—motormen, conductors and other employés—are now serving in the Army or Navy.

Exports from Denmark.—The Danish Government has prohibited the export of electric cables, motor vehicles and parts thereof, rubber, and metals.

Personal.—Private B. Parker, an Accrington tram conductor, who was wounded at the front, is now at home on furlough.

Acting-Corporal W. Clegg, of the Burnley tramway department, who has been serving with the 3rd Rifle Brigade, is in hospital at Leicester suffering from wounds.

Sergt. Robert Greaves, of Ashton, formerly in the employ of the Tudor Accumulator Co., Dukinfield, has returned from the front wounded.

In the "Times" list of members of the House of Commons who are absent from Westminster serving in the Navy, Army or Auxiliary Forces, we notice the names of Major G. H. Bowden and Mr. C. G. C. Hamilton.

A correspondent whose services were accepted for the front in August writes:—"I beg to say that I was unfortunate enough to get in the way of a bit of shrapnel which struck me on the thigh. Since my return I have received my discharge as unfit for further service.—Frank A. Blood, late 6th Dragoon Guards."—The writer has now joined Messrs. Credenda Conduits, Ltd., as their representative for Yorkshire.

Mr. Ernest G. Baker, mentioned in our last issue, is mains assistant, not chief assistant, in the Morecambe Corporation Electricity Department. Mr. W. Mortimer, chief clerk to that department, is serving with the 5th (Reserve) Battalion King's Own Regiment, and Mr. A. Smith, an assistant on the outside staff, is serving with the Royal Army Medical Corps.

Roll of Honour.—Private Wm. Keen who had been employed at the Electric Works, Strand Road, Preston, has been killed in action.

Messrs. John Heywood, of Manchester, have made a handsome board to the order of Messrs. Chas. Macintosh & Co., Ltd., on which it is intended to inscribe the names of men from the works who have fallen fighting for King and country. So far only one name appears on the board, that of Corporal E. J. Walker, Manchester Regiment, who was killed in action at Le Cateau, August 26th, aged 20 years.

Corporal Alexander Mackenzie, 4th Dragoon Guards, killed in action on November 1st, was an electrical wireman in the employ of Messrs. Lowdon Bros. & Co., Dundee.

Electrically-Propelled U.S. Warship.—According to Reuter, the U.S. Navy Department has authorised the statement that the super-Dreadnought type battleship *California* will be electrically propelled with steam turbine-driven generators, motors, &c., giving a minimum speed of 21 knots an hour.

Accident.—John Parkinson (23), of Barrow, was admitted to North Lonsdale Hospital, on November 11th, suffering from severe injuries. He was passing an electric fan at Barrow Shipyard when his clothing was caught, and he was dragged into the fan.

REVIEWS.

Factory Administration and Accounts. By Edward T. Elbourne. London: Longmans, Green & Co. Price 25/-.

This is one of the best and most comprehensive works extant as an analytical study of the problems pertaining to Factory Administration and Accounts as a whole, with contributions on the general problem of industrial works design by Mr. A. Horne-Martin, and on financial accounts by Mr. John Maughfling.

The work is divided into six sections and copiously illustrated. Section I discusses the problem of industrial works or factory design in a general way with a view to giving a mental conception of the broad principles that should be kept in mind in the setting up of a factory, whether conducted by a consulting engineer with the requisite qualifications or by an architect in collaboration with the works staff. Section II deals with general administration, and consideration is given to the factors dominating it independently of any particular office arrangements. This method of treatment has been also adopted throughout the discussion on works administration accounts and financial accounts. Section III comprises a study and discussion of the common elements in works administration. The treatment is fuller than that of general administration, partly because the principles seem to lend themselves to more definite demonstration and partly because a certain elaboration is necessary to show the inter-relation of the works organisation with the commercial and accountancy requirements. Section IV is devoted to works accounts in considerable detail with a view to providing a comprehensive grasp of the whole. Section V consists of a comprehensive set of routine forms, which broadly illustrate the principles outlined in tne preceding sections. The forms are grouped according to the departments first concerned with their use, each form having been either selected or designed for the special purpose of illustrating the work; but it is stated that the proved merits of successful practice have not been sacrificed in any modification for this purpose.

It is properly asserted that the illustrations do not apply equally to every set of conditions, and the tabular illustrations, supported by suggestive notes relative to the routine in each case, will aid as starting points in the consideration of the special requirements of various businesses.

The point is emphasised that no routine form should be adopted unless the local conditions require it, which is, of course, obvious. A more important fact which is sometimes overlooked, or neglected, is that no form should be adopted except as a considered step in the development of a co-ordinated scheme of organisation. The functions to be served by this section are therefore mainly to assist towards the taking of long views and to focus the arguments advanced in the course of the book.

The forms are arranged so as to be read in the ordinary horizontal way, and are printed on right-hand pages so as to allow ready reference from any other point in the book. In the text of the book marginal references are given to the forms illustrating the subject matter of discussion. The left-hand pages facing the forms are ruled for the user of the book to indicate comments and make notes from other sources, particularly for applying the forms to any given works where local considerations must almost necessarily entail some modification.

Section VI presents a definite set of financial accounts, adapted on the one hand to the system of works accounts advocated in Section IV, and on the other hand conforming with the requirements of English company law and the usual accountancy, a clear line of demarcation being drawn between works accounts and financial accounts, and the necessary interlocking exhibited. The section outlines a general system for an engineering and machine-work business.

The classification is simple, adequate and correct, and the descriptive and other observations which follow are to the point. In this particular section there is not advanced anything that can be characterised as being new, though it is only fair to add that the particular sub-division of the subject is of a somewhat formal and restricted character and contains comparatively little ground or fertility for the creation and cultivation of practical ideas unfettered or free from the trammels of orthodoxy. The system delineated is more or less in its main features in general vogue.

The general problem of industrial works design is exhausted under such heads as general considerations, determination of policy, choice of site, labour and labour conditions, general arrangement, power generation and transmission, design and construction of works structure, consideration of plant and equipment, building and starting the works, reconstruction of existing works; whilst general administration is described under such headings as staff organisation, routine organisation, correspondence, publicity and sales, estimates, output considerations, official orders, and working administration under works regulations, labour, drawing specification and patterns, materials, production efficiency and dispatch, and other various sub-headings or divisions. Section IV, Works Accounts, is ably treated with the following main dissections or classifications: functions of works accounts, works expenditure account, standing orders, stock accounts, cost allocation accounts, shop charges, process product, manufacturer's stock product, stocktaking, loose plant valuation, building and fixed plant valuation, works accounts abstracts, and administrative statistics.

Our old friend, or enemy, depreciation, deserves and receives a considerable amount of observation and discussion with some useful tables, in the course of which the writer states that each factory stands alone as to what are proper and adequate depreciation rates to apply. As a matter of valuation, considerable discrimination can be used as to the depreciation rates applicable to particular items, having regard to all the facts of the case. From the financial accounting point of view there is, however, no satisfactory alternative to the use of an average rate graded to an extent according to the classes of plant involved. The plant groupings already given recognise these limitations, and are arranged to minimise the misleading effect of average rates. Even if the depreciation rates were further graded to suit each class of plant included in these groups they would still fail to discriminate between the wear and tear of the different items in each class due to different conditions and makes, and the varying endurance of different types and makes. There is, therefore, little encouragement to consider the increased accounting work necessary to carry out such an idea.

Altogether the preparation of the work, which is of very great value, has been well carried out. There are many matters in the course of the treatise upon which the writer would have wished to comment in detail, but he must submit to space limitations.

The Elementary Principles of Wireless Telegraphy. By R. D. Bangay. London: Marconi Press. Price 1/- net.

This book is intended primarily to appeal to "amateurs" who, having a little technical knowledge, wish to take up the study and practice of wireless telegraphy. Only the underlying principles of the subject are dealt with, and the treatment given to these and to the essential components of a wireless equipment and their *modus operandi* is

excellent. The author deals exclusively with the Marconi system (though the name Marconi does not appear once in the index, and but very rarely in the text). A wireless equipment as a whole is not, however, described; failing a general explanation of the method of working of any wireless installation, followed by treatment of the existing apparatus and underlying principles of different systems of wireless, surely the lay-out and operation of a complete installation should be considered.

It is always a difficult problem in writing an elementary treatise of this kind to determine just how much general technical knowledge should be assumed to be possessed by the reader. The author's introductory pages include very terse and useful explanations of elementary electrical principles and apparatus, in which explanations use is made of a number of excellent mechanical analogies. Yet before we reach "The Principles of Wave Motion," thirty pages (nearly 20 per cent. of the total number) have been filled. What it is so difficult to decide is whether a reader who finds this introductory section necessary will find it sufficient. We believe that the beginner possessed of a certain amount of electrical knowledge will find the author's introduction helpful in recalling and fixing clearly elementary knowledge with which he is already to some extent familiar.

The principles of wave motion and the properties, measurement and production of different types of waves are very well explained between pages 30 and 55. Throughout the work the author's mechanical analogies are apt and accurate. His grammatical style is very "pithy," and demands that the full import of each sentence be weighed carefully by the reader; this is no disadvantage, since there is no ambiguity or obscurity, but simply concentration of information. Oscillatory circuits, problems of energy and power therein, open and closed oscillatory circuits and methods of varying the wave lengths of aerials and closed oscillatory circuits are next dealt with. By this time we are half way through the book, and the question arises whether the beginner is likely to appreciate in a first reading the trend of the information placed before him. Would it not have been better first to outline the fundamental equipment and operation of a complete station, so that the reader might more easily appreciate the exact place of each component and problem in the scheme of things?

The purpose and construction of induction coils is next explained, and important sections are devoted to factors limiting the power in oscillatory circuits, the auto-jigger, reaction of secondary on primary, resultant wave length and calculation of coupling. The construction and use of wave meters and adjustable condensers are explained, and the author passes on to receiving circuits and detectors. Crystal detectors, carborundum and magnetic detectors are dealt with in detail. Surely electrolytic detectors are worth brief mention in a treatise on "essentials?" Types and size of aerial receive treatment in the final pages of the book, which is excellent value and certainly to be recommended to amateurs, Territorials, Boy Scouts, and others wishing for a sound treatment of the elements of wireless telegraphy. In later editions we should like to see a contents sheet, a specific description of a wireless installation as a whole, and some mention of the characteristic features and relative merits of different systems of radio-telegraphy.

Electrical Engineering. A First Year Course. By Frank Shaw, B.Sc. London: Routledge & Sons. Price 2/- net.

This is a small manual intended for the use of first year technical students who have already taken a preliminary course of mathematics, physics and chemistry. The elements of electricity and magnetism are treated very briefly in the first two chapters; a fairly full account of electromagnetics is then given, followed by half a dozen chapters on the dynamo and motor. The treatment is generally clear, and in spite of some weak diagrams the author has succeeded in giving a sound introduction to the study of electrical machines. There are also good chapters on electric lighting and heating and electrical measuring instruments.

The book suffers chiefly from the poorness of the illustrations. Most of the diagrams are clear enough, but with more discretion as to the relative sizes of the pictures the book might have been greatly improved. Some quite unimportant diagrams occupy a full page, while far more deserving blocks have been given but a few square inches. Some heavier type in place of the italic paragraph-headings would also improve the book. Altogether, and apart from these defects, Mr. Shaw has produced a very useful little book for first year students, and, what is of considerable importance to such students, it is published at a very moderate price.

P.H.S.K.

BUSINESS NOTES.

Incorrodible Steel Tubes.—The British Mannesmann Tube Co., Ltd., have just completed a plant for ferro-zincing and ironising tubes, under licence from Mr. Sherard Cowper-Coles. It is stated that the purer iron is, the less liable it is to pitting and corrosion, chemically pure iron being practically rustless. "Ferro-zincing," or "ironising," turns these facts to account by coating the steel surface with almost pure iron, the only impurity of any significance being hydrogen. The presence of hydrogen is an advantage, as it makes the iron slightly more electropositive to the underlying steel than it would otherwise be, so that it forms a better protective coating. Another advantage of the coating of electrolytic iron is that the coating is homogeneous, is not under unequal strain caused by mechanical operations such as drawing or hammering, and has not been subjected to any heat or mechanical treatment which of necessity causes impurities to be absorbed by the metal so treated.

It is found in practice for many purposes advantageous to coat the electrolytic iron surface with zinc, as a zinc coating with an intermediate layer of pure iron-hydrogen alloy gives greatly increased life to an ordinary steel tube or plate.

Catalogues and Lists. — Messrs. Credenda Conduits Co., Ltd., Chester Street, Birmingham.—Pamphlet F 18 illustrating, with prices, a number of Credenda electric fires, embodying their patent hot-bar system of heaters, which was described and illustrated in our issue of August 28th last. Electric wall heaters, grills, kettles, irons, lamp radiators, &c., are also dealt with.

Messrs. F. W. Potter & Co., Phipp Street, Great Eastern Street, London, E.C.—Illustrated leaflet giving particulars and prices of asbestos-woven wire-resistance nets of British manufacture.

Messrs. E. A. Reed & Co., Ltd., 14, Victoria Street, Westminster, London, S.W.—Twenty-page illustrated catalogue (new edition) of coal, ash, &c., elevating and conveying machinery of different types, mining and contractors' plant, steel and iron constructional work, steel chimneys, &c.

Messrs Elliott Bros., Central Buildings, Westminster, London, S.W.—Illustrated pocket pamphlet giving prices and particulars of Elliott micrometers and speed indicators made at their Lewisham works.

The Electrical Apparatus Co., Ltd., Vauxhall Road, South Lambeth Road, S.W.—Leaflet H 17A, covering shunt field regulators for ·15 to 100 amperes and 1·2 to 3,500 ohms. For each range of current and resistance two or three prices are given for varying number of steps. In all cases prices are given for front and back-of-board types, with and without C.I. cover for front, with extra price for enamelled slate bases and interlock for motor regulators. Dimensions, shipping specification and information regarding full load and shunt field current are given, the latter based on standard machines.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Volume 2 (second edition) of Messrs. Veritys' catalogue of electric supplies has recently been issued. It is as in the case of the first edition most convenient in size and its general appearance—well bound and quite unobtrusive—is all that can be desired, indeed it might be mistaken for the most harmless of text-books, instead of a business-getting catalogue. It consists of close upon 500 pages of art paper, and the things with which it deals form a multitude that no man can number in a hurry, so that we can do no more than indicate the general nature of the contents. If we say that it begins with fuseboards and ends with cooking appa-

ratus that is because we must begin somewhere and wish to break it gently. Between those two ends there is a vast host of such electrical supplies as to justify the compilers in claiming that "it is crammed full of real-selling material." Since we wrote of "Verity in Three Volumes," now some years ago, there have been developments in small electrical work which of necessity are reflected in a catalogue of this kind, and some of the advances are to be found in the new sections covering theatre and cinematograph apparatus, portable electricity, &c. Glancing through the volume in a general sort of way we observe hundreds of illustrations, and thousands of prices, as well as code-words and brief descriptive notes, relating to Aston switches and switch accessories, all kinds of lampholders, cut-outs and connectors, shade-tilting arrangements, wires and cables, conduits and fittings, turndown lamps and wireman's tools and sundries, Conradty carbons, Holophane and other shades, bells and telephones, telegraph material and fire alarms, medical coils, electric signs and illumination devices, pocket lamps and batteries, lighting sets, various makes of accumulators, motor-car requisites, and electric heating and cooking apparatus. The book to which we refer is known as the "Sundries" section of "Veritys' Electric Supplies" (Vol. 2, new edition)—contractors and others interested will bear that in mind.

Messrs. Parmiter, Hope & Sugden, Ltd., Hulme Electrical Works, Manchester.—New price list (12 pages), containing description and illustrations of Hope's patent Fluvent fuse system, and giving recent tests of same certified by Mr. S. L. Pearce, city electrical engineer of Manchester.

Trade Announcements. — Messrs. Haylock and Haslett (formerly Ralph H. Haylock & Son), are trading as wholesale electrical merchants, at 63, Queen Victoria Street, E.C.

Messrs. Simplex Conduits, Ltd., announce that Mr. J. H. Baldwin, of 88, Wallasey Avenue, Belfast, is now acting as their Irish representative.

New offices and showroom premises at 5, Church Street, Enfield, N., have been opened by the Electricity Supply Co.

Book Notices.—*Made in England* is the title of a new penny monthly publication. It contains a large amount of interesting matter specially prepared to be of value to the British manufacturer, buyer, inventor and capitalist in connection with the present opportunity for capturing German export trade. Mr. L. G. Chiozza Money, M.P., contributes an article on the well-worn subject "British Consuls and British Trade," and other articles treat of the financial side of the war on German trade, motor-car trade, tungsten for steel and lamp manufacture, and so on.

The Mechanical World Pocket Diary and Year-Book for 1915 (Manchester: Emmott & Co., Ltd., price 6d. net), now issued for the twenty-eighth year, contains much new matter; structural iron and steel work is dealt with in a new section, and other features are articles on limit gauges and flat plates. Other parts have been revised and extended.

Questions and Solutions in Telegraphy and Telephony. By H. P. Few. London: S. Rentell & Co. Price 2s. 6d. net.—This is the fourth edition of a work which must be extremely useful to candidates for the examinations of the City and Guilds of London Institute in the subjects named, containing the questions set from 1904 to 1914 inclusive, with solutions by the author. Some of the questions set at the Departmental written examinations for overseers and assistant superintendents are also dealt with, and a number of the oral questions are included. Numerous diagrams are given, and numerical examples are fully worked out. An index facilitates reference to any particular subject. The frequent reprints and new editions of the book clearly indicate its popularity.

Electric Power Transmission by Aluminium Conductors.—This brochure, issued by the British Aluminium Co., Ltd., has been brought up to date, and the most recent regulations in force in various countries have been included, while a table of safe currents for overhead aluminium conductors, on the basis of temperature rises of 50 and 100° F., and new matter dealing with line regulation, the erection of aluminium conductors, and scrap value, have been added. Remarkable progress has been made in the use of aluminium for power transmission; on the Big Creek line, for example, which delivers energy at 150,000 volts some 241 miles from its source, 2,678 tons of aluminium strand was employed. The information given is so practical and useful, that we should consider the brochure indispensable to any engineer engaged upon the design and erection of important overhead lines.

"Laboratory Course in Electrochemistry." By O. P. Watts. London: Hill Publishing Co., Ltd. Price 4s. 2d. net.

"Principles and Practice of Electrical Engineering." By A. Gray. London: Hill Publishing Co. Price 12s. 6d. net.

"Electric Bells, Alarms, and Signalling Systems." By H. G. White. London: S. Rentell & Co., Ltd. Price 1s. 6d. net.

"Questions and Solutions in Telegraphy and Telephony." By H. P. Few. London: S. Rentell & Co., Ltd. Price 2s. 6d. net.

"Electric Mine Signalling Installations." By G. W. Lummis Paterson. London: Constable & Co., Ltd. Price 4s. 6d. net.

"Drawing for Electrical Engineers." By G. W. Worrall. London: G. Routledge & Sons, Ltd. Price 2s. net.

"Dynamo and Electric-Motor Building." By A. H. Avery. London: Cassell & Co., Ltd. Price 1s. net.

"A Manual of the High-speed Steam Engine." By H. Keay Pratt. London: Constable & Co. Price 5s. net.

Bankruptcy Proceedings.—H. B. Graham, consulting engineer, Craigs Court House, Charing Cross, S.W.—A first dividend of 9d. in the £ is payable any day (except Saturday) at Bankruptcy Buildings, Carey Street, W.C.

Liquidations.—Electro Steel Founders, Ltd.—A petition for winding up this company has been presented by Mr. A. E Owen, engineer, The Lawn, Streetly, Sutton Coldfield, a contributory, and it is to be heard on December 1st, in London.

Gyroscopic Motor Syndicate, Ltd.—A meeting of creditors will be held on December 18th, at 4, Mount Street Square, Cardiff, to hear an account of the winding up from the liquidator, Mr. R. C. Brown.

Pioneer Pump Patents, Ltd.—A meeting of creditors will be held on December 19th, at Clifton Street Works, Notting Hill, London, to hear an account of the winding up from the liquidator, Mr. G. H. Smart.

Fire.—A portion of the works of Bi-Metals, Ltd., and Messrs Neville Williams & Co., 57, Lant Street, Borough, London, S.E., was destroyed by fire on Friday last. Practically none of the finished stock was damaged, so that there will be no delay in the execution of orders.

LIGHTING and POWER NOTES.

Altrincham.—Application has been made to the B. of T. for the transfer to the Altrincham and District Electric Supply Co., Ltd., of the Altrincham and Bowdon and Ashton-on-Mersey E.L. orders.

Argentina. — The Commissioner of the La Plata Municipality has been authorised to come to an arrangement with the local electric light and gas companies in connection with the tariff for private service.

The Government is dealing with the question of reduction of tariffs in Tucumen, which has arisen between the consumers and supply company.—*Review of the River Plate.*

Ashford.—The 1911 E.L. order has been revoked.

Atherton.—The Howe Bridge Spinning Co., Ltd., has made application to the Council for energy for driving three 100-120-H.P. motors, the supply being three-phase, and the Council has decided to take steps to install three transformers and to lay the necessary cable to meet the demand.

Australia.—The Melbourne City Council has decided to spend on its electricity undertaking £145,000 during the next three years, £40,000 in 1915, £69,000 in 1916, and £35,000 in 1917. The extension proposed for 1916 includes a 5,000-KW. three-phase turbo-alternator, with additional boilers. This plant is considered necessary to meet the increased demands for electricity, and £20,000 is provided for works outside the power house, including mains.—*Tenders.*

According to the *Commonwealth Engineer*, the City Council some years ago erected a refuse destructor adjoining the electricity works in Spencer Street, against the advice of its engineer. Now additions are required to both plants, and the only way out of the difficulty is to purchase adjoining property.

Barnes.—Private Bill.—The U.D.C. has informed the I.M.E.A. that it has in contemplation the question of promoting a Private Bill which would include the electric lighting clauses proposed to be included in the Association's Private Bill.

Blyth.—Electric Pumping.—The steam pumps in connection with the large graving docks of the Blyth Shipbuilding and Dry Docks Co. are shortly to be replaced by an electric pumping installation. This new pumping plant will consist of two Gwynne pumps, capable of pumping 24,000 tons of water in two hours, driven by two 260-H.P. Bruce Peebles motors, running at 330 R.P.M., and taking current from the mains of the Newcastle-on-Tyne Electric Supply Co.

Chile.—According to the *Review of the River Plate*, the electricity company at Vina del Mar has decided to stop the public lighting service unless it is paid what it is owed.

Consett.—Street Lighting.—The U.D.C. has been informed that the Cleveland and Durham Electric Lighting Co. expected to complete the whole of the lighting in the course of a few days.

Continental Notes.—Austro-Hungary. — According to the *Morning Post*, Vienna, Buda-Pest, and other large cities and towns, are beginning to reduce the public lighting since the productive capacity of the electricity and gas works has been seriously affected owing to the shortage of coal and oil supply.

Ealing.—No charge is to be made under the contracts for outside lighting of shops, &c., during the period in which the police regulations for reduced lighting remain in force, provided each consumer undertakes to continue his contract from the time at which it would, in the ordinary course, expire, for a period equal to the duration of the first period referred to.

Harrogate.—Proposed Extended Supply.—The Corporation is proposing to seek a general order to supply electricity in surrounding districts. At present the Corporation has power to supply Starbeck, three miles out, and it is seeking powers to supply Knaresborough, Spofforth, Ripley, Birstwith, Hampsthwaite, Haverah Park, Rigton, Kirkby Overblow, Dunkeswick, and Weeton. The area encroaches on other Unions, and some comment has been aroused owing to the sparsely populated character of the district. It is said that many of the villages welcome the proposal. The application for a prov. order is to be made before December 21st next.

Hendon.—Workhouse Lighting.—The B. of G. has decided to have electric light installed in the non-infectious wards, and has resolved to engage an expert, at a fee of 20 guineas, to report as to the question of the supply of electricity to the institution. The Sub-Committee appointed reported that the cost of lighting was slightly in favour of electricity, but taking into consideration the question of decoration and maintenance, together with the health of the inmates, the advantage of electric light was substantial.

Huddersfield.—Annual Report.—The statement of the past year's working of the electricity department shows that the consumers increased by 626, making a total of 5,814, and motors reached a total of 8,396 H.P. The war is given as a reason why the new 5,000-kw. turbo-generator ordered at the beginning of the year, and now being erected, will be delayed beyond the specified time for completion, and the same difficulty is being experienced in regard to the delivery of converters at the tramway power station. Seven and three-quarter miles of cable have been laid in the roads, bringing the total length of mains to 162¼ miles. The public lighting in the Longwood ward has been converted from gas to electricity, and the adoption of the same system has effected lighting improvements at Longwood Bridge and Lockwood.

India.—Calcutta Public Lighting.—The Special Committee of the Corporation recently considered comparative estimates of cost of electric and high-pressure gas lighting for Chowringhee Road. It was proposed to use 66 gas lamps 150 ft. apart, or 83 electric lamps 118 ft. apart; the former were of 1,000 and the latter of 900 C.P. The chairman said that in every way the estimates worked out in favour of electricity; the cost of maintenance was Rs. 270 per lamp per annum for gas, and Rs. 209 per lamp per annum for electricity, and the total cost of electricity per annum would be Rs. 17,347, against which they would get a Government grant of about Rs. 4,500. It was resolved to recommend the offer of the Calcutta E.S. Corporation to install 83 lamps, and light and maintain them for Rs. 209 each per annum for 3,914 hours, or for Rs. 161 per lamp if extinguished at 1 a.m., the period of the contract to be five years.

The Madras Government has given the Madras Electric Supply Corporation permission to introduce the A.C. system of supply in addition to the existing three-wire D.C. system.

The Governor in Council is urging all lift owners in the Bombay Presidency to have them insured and inspected. Since the introduction of electric power numerous electric lifts have been installed in hotels, offices, shop and houses, and one or two serious accidents have occurred.

Japan.—Two transformers, having a normal continuous rating of 360,000 volts, and 500 000 volts for short periods, were recently built by the Westinghouse Co., East Pittsburg, for the Inawashiro Hydroelectric Power Co., one being installed in the generating station on the Nippashi River at the outlet of Lake Inawashiro, and the other in the receiving sub-station at Tokio, about 145 miles away. They will be used for testing the transmission lines and the apparatus in the stations. The machines measure 19 ft. from the base to the top of the terminals, and the tanks containing the transformers proper are cylinders 9 ft. high and 9 ft. in diameter. One high-tension terminal of each transformer is grounded to the core and the case. By connecting the cases of the two in series, it is possible to develop a potential of 1,000,000 volts between the two high-tension terminals.—*Indian Textile Journal.*

The electric lighting of Tokio is at present being conducted under most complicated conditions, and in view of the competition among the municipal, the Tokio, and the Nippon electric lighting concerns, the Japanese Department of Communications is, as a supervising body, keeping a close watch on every movement of the different competitors. In this connection, the Department is reported to have decided to commence a formal investigation of the present phase of competition, and also of the opinions of consumers with regard to the position.

Leeds.—Half-Year's Working.—The returns of the Corporation electricity department for the half-year ended September 30th show that 18,626,358 units were sold, as compared with 12,858,263 in the same period of 1913; the former figure includes some 2 million units for private lighting, 10 million for power and heating, 255,000 for public lighting, and 8¼ million units for traction. Private lighting and power sales are both higher than in the previous year, despite the war, and traction supply increased by some 6 million units, due to the transfer of generation from the Crown Point (tramway station) to the Whitehall Road station. The lighting consumers numbered 10,226, as compared with 9,612, and the H.P. of motors connected was 29,052, as compared with 26,842. The larger proportion of low-priced traction units reduced the average price from 1·02d. to ·83d. per unit. The strike in the early part of the year, and the necessity of using reserve plant, owing to the small margin available, were not favourable to economy in working, but working expenses figured at ·39d., as against ·43d. The gross profit for the six months was £33,553, as against £31,756 in 1913, and the net result a deficit of £11,686, as against a deficit of £6,417—these figures being no criterion of the whole year's working, as the winter output is much greater than the summer output referred to above.

The Corporation electricity department last week took over the undertaking of the Roundhay and District Electric Lighting Co., Ltd., which has, since 1901, supplied current to the Roundhay district. On the recent extension of the city boundaries, when Roundhay was included, the company retained the right to supply until such time as the Corporation should purchase its undertaking. From the consumers' point of view, the district will benefit, as the Corporation prices for current are 50 per cent. lower than those charged by the company.

Litherland.—Prov. Order.—The U.D.C. has decided to apply to the B. of G. for a prov. order for electric supply.

Malling (Kent).—Workhouse Lighting.—The B. of G. has decided to obtain estimates for lighting the workhouse by electricity and utilising it for cooking, current to be generated on the premises.

Manchester.—According to a Scottish correspondent, a deputation from Manchester has visited Edinburgh to inspect the arrangements at McDonald Road station for utilising sewage water for condensing purposes. It is proposed to erect the new Manchester power station adjacent to a sewage works, which deals with 36 million gallons of sewage daily, which could be screened and utilised for condensing purposes.

Nuneaton.—The T.C. has decided to contribute towards the cost of the promotion of the Bill of the I.M.E.A. Provided current is already available in the premises, no charge is to be made for electricity supplied to houses exclusively occupied by Belgian refugees.

Rawtenstall.—Proposed Loan.—A L.G.B. inquiry was held on Tuesday last into the application of the T.C. for sanction to borrow £6,500 for the electricity undertaking.

Rochdale.—Street Lighting.—The B. of G. has decided to extend the lighting by electricity of Birch Hill Lane towards Shore boundary upon terms which it is expected will be approved by the Wardle U.D.C.

Slaithwaite.—E.L. Scheme.—The U.D.C. has instructed Mr. J. Schofield, of Bradford, to prepare a scheme for generating electricity for lighting, with specifications, quantities, and estimates for a plant to produce 50,000 units per annum.

South Shields.—Despite the effects of the war, and the fact that a hundred arc lamps are out of lighting, and that all public houses are closing at 9 p.m., the units generated at the Corporation electricity works from August 6th to October 29th last reached 1,204,765, as compared with 1,196,011 in the previous year, an increase of ·7 per cent. In the period from March 31st to October 29th, the units generated amounted to 3,052,590, an increase of 5·5 per cent. over the 1913 figures.

Sunderland.—The Corporation has agreed that power consumers now supplied upon a kilowatt rental, plus a unit charge, be supplied in future with electricity for office and similar heating and cooking apparatus at the same unit rate as the existing supply, plus the coal charge, and that no kilowatt rental be made in respect for such apparatus.

Tavistock.—Opening Ceremony.—On Wednesday, last week, the electricity works were formally opened. The contractors for the plant, &c., were Messrs. W. G. Heath & Co., of Plymouth, who have supplied 30 miles of overhead and four miles of underground cable, street pillars, poles, fittings, &c., for 160 street lamps and a generating plant, consisting of a 75-H.P. suction gas engine and dynamo, with battery, booster, balancer, &c., and an auxiliary water turbine plant.

Torpoint.—The U.D.C. has decided to discuss with the E.L. Co. the question of entering into an agreement with regard to private lighting.

Warrington.—The Corporation is applying for powers to supply electricity to Stockton Heath.

Wigan.—At the last meeting of the Ince D.C. some discussion took place with reference to explosions in electric cable manholes, and it was agreed that the clerk of the D.C. write the T.C. of Wigan calling attention to the danger involved, and pointing out that responsibility for any accident which might occur would rest with the Corporation.

Worsley.—Street Lighting.—The U.D.C. has decided to ask the Tramways Co. to fix four 100-C.P. lamps on poles at the junction of Manchester Road and Walkden Road.

TRAMWAY and RAILWAY NOTES.

Australia.—The lease of the Melbourne Tramway and Omnibus Co. expires on July 1st, 1916, on which date certain of the municipalities through which the tramways run take over the system.—*Commonwealth Engineer.*

Bradford.—Halfpenny Fares.—The Chamber of Trade Council has discussed at considerable length the subject of halfpenny tramway fares. Mr. John Preston submitted statistics from the tramway authorities of Leeds, Sheffield, Hull, Glasgow and Aberdeen, showing how generally successful the halfpenny fares had been found in those places, and gave detailed comparisons showing that, in regard to Bradford, people who lived in outdistricts several miles away, and used the railways, travelled to town at materially cheaper rates than those who lived within a mile of the centre of the city and used the trams. Eventually a resolution was carried urging the Tramways Committee to consider the advisability of giving a six months' trial to the adoption of halfpenny fares on all sections of the local tramways.

Canada.—The Board of Control recently agreed to an application to the Dominion Railway Board for an order compelling all railways entering the city to electrify their systems to a point not less than two miles beyond the Toronto city limits. Eleven out of thirteen districts north of Toronto, have voted in favour of hydro-radial lines under the scheme of the Hydro-Electric Commission, and subject to the Dominion Government granting a mileage subsidy.—*Can. Elect. News.*

Glasgow.—New Type Car.—The Corporation is experimenting with a new type of car in which the special features are the introduction of a capstan wheel and gearing in place of the ordinary brake wheel, to give more room on the platform; a front exit on the platform for the convenience of downstairs passengers; and the provision of a pivoted seat for individual passengers on the upper deck, so that the seats can be swung round to suit the direction of travelling. The pairs of seats are not in line so as to allow more shoulder room and a wider central gangway.

Ilford.—The B. of T. has informed the Ilford tramways manager that it is proposed to make regulations with regard to trolleys attaching to vehicles using a tramway.

Japan.—According to the *Railway News* the work of making the existing double-track line from Tokio to Yokohama into a four-track line has been practically finished. The old track will continue as a steam line, while the new track will be used for electric services. Electric cars will run from the new Tokio central station; the various intermediate stations have been rebuilt, and the work has taken some five years to carry out.

Lepton.—Proposed Tramway Extension.—The U.D.C. has decided to meet a deputation from the Grange Moor Co-operative Society with respect to the extension of the Huddersfield tramway system to the district.

London.—L.C.C.—The Highways Committee recommends that arrangements be made to increase the existing car services, and that an additional supply of power up to 1,500 kw. be obtained from the London Electric Supply Corporation, at £3 per kw. a year plus ·4d. a unit. The price previously paid the company was £3 per kw. plus ·35d. a unit, the increase of ·05d. per unit being due to the increased cost of fuel. The increased power will be sufficient to run 50 or 60 additional cars, and will be provided at the Lewisham sub-station. The cost is estimated at £6,750 for five months.

Electric Delivery Vans.—As indicating the progress that the electric delivery vehicle is making in the London district, it is interesting to learn that Messrs. Harrods, Ltd., in addition to a number of three-wheel machines, have now in service or on order no less than 28 Elison electrics.

Richmond (Yorks.).—The Light Railway Commissioners have granted an order authorising the construction of a light railway from Richmond-on-Tees to Reeth.

Stirling.—The first petrol-driven tramway car in Scotland, on the Stirling and Bridge of Allan route, has proved an unqualified success; the passengers carried on the section where the new car has been in constant use have increased by no fewer than 24,300. It has been decided, after the encouragement shown to the petrol car, to have the whole tramway system electrified. The Corporation of Stirling will probably take the tramway system over after the war has ceased, and meantime the Tramway Co. has obtained an extension of the licence permitting it to experiment with the petrol tramcar for another year.

TELEGRAPH and TELEPHONE NOTES.

An Automobile Laboratory.—For some time past the G.P.O. authorities have been making use of hired motor vehicles fitted up with the necessary apparatus for testing the main telegraph cables throughout the country. As a result of the experience gained, they have now commenced to purchase a number of motor vehicles for this work. One of the first to be completed is a 15-18-h.p. Buick, which has been fitted with a special van body by Messrs. Hora, of Peckham. The body, which forms a travelling office and laboratory, is fitted with all the necessary instruments for cable-testing purposes, the outfit including a dynamo and a battery of accumulators.

Alien's Wireless Installation.—On Tuesday a court-martial was held at Woolwich on Harold Fochtenberger, alias Harold Falconer, described as a wireless engineer, who was charged with having in his possession wireless telegraph apparatus at Thorpe Bay, Southend, and Avonmore Road, South Kensington. The accused pleaded not guilty to both charges. Detective-inspector Beavis stated that on October 28th accused admitted to him that the wireless installation at Thorpe Bay belonged to him, and that he had a complete and powerful installation stored at Messrs. Whiteley's repository. Frank William Davey, assistant engineer at the G.P.O., said the apparatus comprised a complete wireless installation, which would be capable under ideal conditions of communicating over a distance of 150 miles. The prisoner stated that he was not aware that the possession of wireless apparatus was forbidden; he thought a licence was only necessary for apparatus in working order. The trial was concluded.

India.—The new wireless station at Madras has been completed and opened.—*Indian Engineering.*

Secret Wireless Stations.—A secret wireless telegraph station is reported to have been discovered in Valparaiso. Two private stations in the capital have been discovered and dismantled by the police.—*Review of the River Plate.*

Commander Lupcke and the wireless operator Voltz, of the German warship *Preussen*, who are interned at Sabang Bay, Batavia, have been arrested by the Naval authorities. The communication between the antenna and the wireless rooms had been broken, but it was found that a wire had been passed along the mizzen mast from the antenna to a receiver under the pillow of the wireless operator. The authorities have ordered Lupcke and Voltz to be tried for violation of Dutch neutrality.

It is reported that the United States Government has sent secret service agents to inspect a wireless station which was accidentally discovered by some hunters in the Maine woods. The station is supposed to have been operated in German interests.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—December 28th. Victorian Railways. Three 50-kw. static transformers. Contract 27,727. Contractors' Room, Spencer Street.

December 9th. 1,200 yd. 0·3 sq., 2,400 yd. 0·25 sq., 1,600 yd. 0·15 sq., 660 yd. 7/16 S.W.G. single conductor lead-covered cable, 880 yd. 7/16 S.W.G. concentric lead-covered cable, for City Council. See "Official Notices" to-day.

Brisbane.—December 21st. City Council. Motor-generators and switchgear suitable for electric vehicle battery charging. Specifications, 10s. 6d., from City Electrical Engineer.

January 6th. Copper wire and accessories, paper-insulated lead-covered cable, for P.M.G. See "Official Notices" to-day.

Perth.—December 16th. Telegraph and telephone instruments for P.M.G. See "Official Notices" November 13th.

Ashton-under-Lyne.—November 25th. Engine slack. Borough Electrical Engineer, Wellington Road.

Atherton.—The U.D.C. has decided to invite tenders for three transformers, and to request Messrs. Callender's Cable Co., Ltd., to tender for 300 yards of cable.

Barnet.—December 7th. B. of G. Electrical power and lighting plant, electric lift, &c., for the Guardians of Barnet Union. Particulars and forms of tender from Messrs. Williams and Cox, architects, 34, Henrietta Street, Covent Garden, W.C.

London.—L.C.C. December 8th. (*a*) H.T. and L.T. switchgear, (*b*) gravity bucket ash conveyor in connection with tramways. See "Official Notices" November 13th.

Bethnal Green.—December 2nd. H.T. and L.T. cables and roadwork, static transformers, sub-station switchgear, for the B.C. See "Official Notices" to-day.

Manchester.—December 16th. Corporation. Ten 50,000-lb. water-tube boilers complete; two 15,000-kw. turbo-alternators complete. See "Official Notices" November 13th.

December 1st. The Tramways Committee invites tenders for tramcar trucks. Mr. J. M. McElroy, General Manager.

Newcastle-on-Tyne.—November 23rd. Incandescent lamps and arc lamp carbons for a year, for the Tyne Improvement Commissioners. Mr. J. McDonald Manson, General Manager and Secretary, Bewick Street.

(*Continued on page* 696.)

THE GOVERNMENT ELECTRIC POWER STATION OF BANGKOK.

By FRANCIS B. SHAW, A.M.Inst.C.E., A.M.I.E.E.,
Electrical Engineer to the Government of Siam.

(*Concluded from page* 663).

Distribution.—All the high-tension distribution, except for a few short lengths of cable, is by overhead lines, the voltage being 3,500 transformed to 110 volts for lighting and small motors. The use of the overhead system is due to the high initial cost of a cable system; the rapidly changing nature of the district, frequently requiring a supply in an unexpected quarter; and the frequent demand for large temporary installations, *e.g.*, for illuminations, &c., which require large transformers to be put down for a few days only.

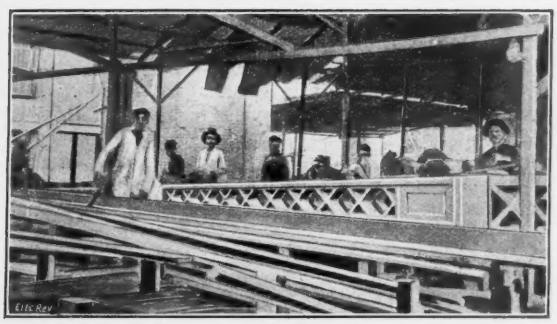


Fig. 21.—Casting Ferro-concrete Poles.

Moreover, the supply is often carried along roads which may, from time to time, be altered—the replanting of trees along them being a frequent source of trouble to our present L.T. cables; many canals are crossed by bridges of a temporary nature, which are slowly being replaced by more permanent ferro-concrete structures, and at certain periods of the year many roads are partially inundated by the river being in flood.

It was decided to depart from the previous practice of using teak posts for the overhead lines, and to use ferro-concrete poles. These have all been constructed locally, in the manner described later.

Great care has been taken to make the lines as permanent and as free from any possibility of interruption as possible. All main feeders are run in duplicate, each phase being composed of two sets of three lines. No. 1 feeder, which supplies the waterworks, is composed of six lines, each of 35-mm². hard-drawn copper. At all crossings of roads double insulators have been used, and at the railway crossing double suspension has been employed. Lightning arresters have been installed at the sub-stations and some of the exposed transformer positions. At the power station, in addition to the multigap lightning arresters, Gola arresters have been fitted. At sub-stations multigap arresters are used, and in a few cases horn type arresters have been installed.

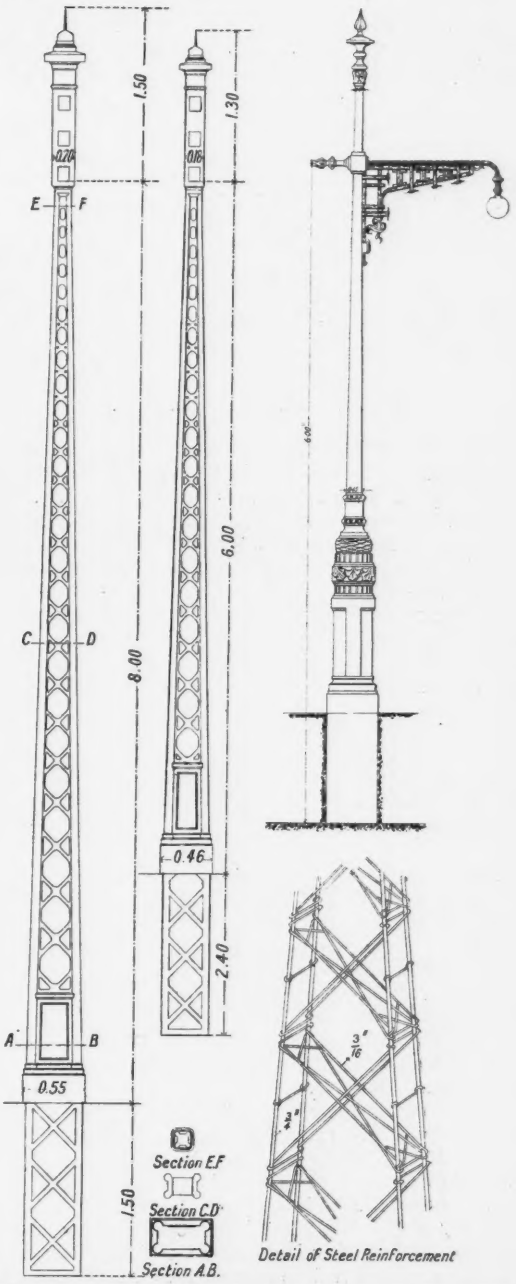


Fig. 22.—Ferro-concrete Lattice Poles and Tubular Lamp-post.

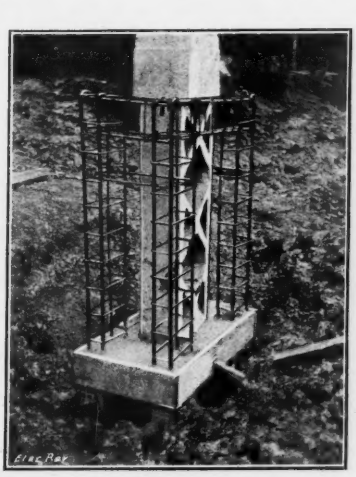


Fig. 23.

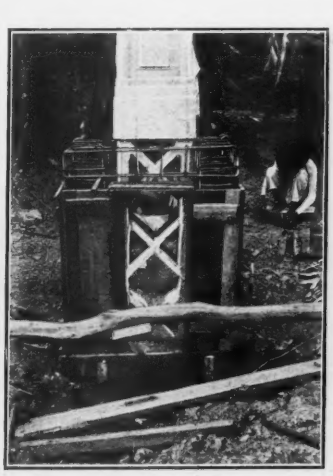


Fig. 24.

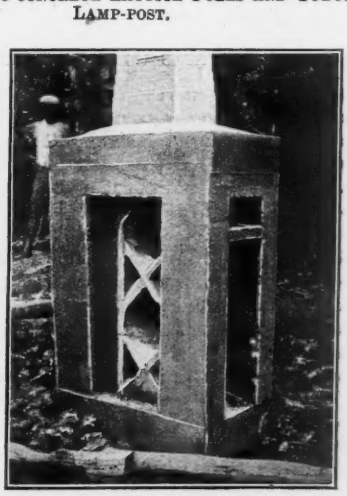


Fig. 25.

Construction of Special Base for Ferro-concrete Pole.

No. 2 feeder supplies several of the Royal palaces, and consists of six lines, each of 50-mm². hard-drawn copper. The standard spacing for all the lines is taken as an equilateral triangle of 400-mm. sides, and the tension is 6 to 7 kilogrammes per mm². No. 3 feeder will also be principally for lighting and similar in all respects to No. 2.

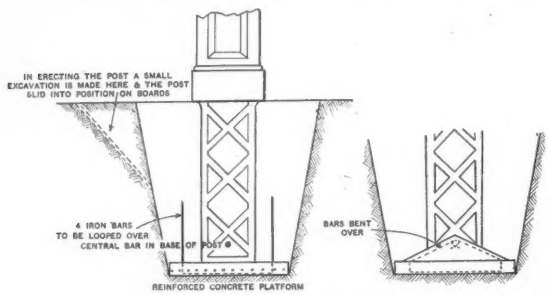
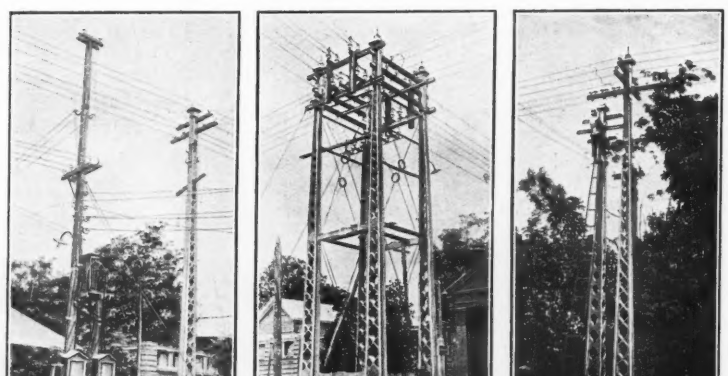

IN ERECTING THE POST A SMALL EXCAVATION IS MADE HERE & THE POST SLID INTO POSITION ON BOARDS
4 IRON BARS TO BE LOOPED OVER CENTRAL BAR IN BASE OF POST
BARS BENT OVER
REINFORCED CONCRETE PLATFORM

Fig. 26.—Foundation for Pole.

Sub-stations.—There will be seven principal sub-stations, the high and low-tension boards for which have been constructed by the British Thomson-Houston Co., Ltd. In certain of the sub-stations arrangements are provided for connecting up Nos. 1, 2 and 3 feeders in order that in case of damage or accident to any one feeder, important points may be fed from another direction. No automatic selective switchgear is employed, but telephonic communication with the power station from these sub-stations is provided by the department's private lines.

Street Lighting.—The ordinary street lighting is effected by means of 50-c.p. lamps on brackets, for which provision has been made on all the ferro-concrete poles. On certain of the main roads 1,000-c.p. lamps are used. The whole of the street-lighting system is controlled from a small switchboard situated in the power station. From this switchboard pilot lines are run to the various sections, and these control automatic switches. A lamp on the switchboard indicates immediately when the street lighting is in operation, and another lamp indicates if any fault arises. With this system it is unnecessary to run special high-tension lines solely for street lighting purposes, as was the former custom here.



Old and New Poles. Four-pole Turnout. Two Types of Pole.

Fig. 27.

Reinforced Concrete Poles.

For the past eight years the Siamese Government have been using reinforced concrete poles of various types both for street and park lighting and also for transmission lines. Previous to this teak poles and certain other woods more or less unattacked by the white ant were used.

The average life of a teak pole is about 15 years, and that of the other woods used from five to seven years. Of late it has grown more and more difficult to obtain suitable teak poles, and the price of teak has risen considerably. On this account reinforced concrete poles were adopted for the transmission lines of the new Government electric power station.

It was found that reinforced concrete poles could be made locally at nearly the same price as teak poles, the latter of, say, 11 metres, costing £2 15s., and reinforced concrete poles, £3. Furthermore, the value of a teak log increases very rapidly with increase in length, straightness, and freedom from flaws. Thus no very fixed basis of comparison of price is possible.

The concrete pole of the lattice-work pattern adopted by us is only about 10 per cent. heavier than a teak pole of the same length, and this extra weight is more than counterbalanced by the fact that the centre of gravity is at slightly less than one-third of the length from the butt.

This fact makes the erection of the pole a far more simple matter than erecting a teak pole, which is usually of nearly uniform weight throughout. Again, the base of the concrete pole is constructed to give a large bearing surface and area to resist movement and sinkage in soft ground.

The wooden pole has usually a pointed or rounded end, and requires elaborate cross-tree timbering to prevent movement or sinkage. Another point not usually taken into account is the elasticity of the reinforced concrete pole. With a teak-wood pole line, if by reason of a tree falling on the line, or a fire, all the lines between two poles are broken, the wooden poles usually give in the ground, and require very careful straightening. With concrete poles this is not the case, as they are sufficiently elastic for the strain to be distributed along several poles on either side without any movement of the pole bases.

Three types of ferro-concrete poles are in use. The ordinary type of pole for carrying high-tension lines is 11 metres in length, and is constructed to take three cross arms and to withstand a pull at the middle cross arm of 200 kilogrammes, with a factor of safety of four. In certain cases, such as termination points, turnouts, special crossings as those at "klongs" (canals), roads, &c., a special pole to withstand a pull of 2,000 kg. is employed. In some cases, such as at turnouts, four ordinary type poles are placed to form a tower on which the transposition of lines can be easily effected. The third type of pole is 6·50 m. in length, and will stand a pull of 200 kg. This is used only for low-tension lines.

Tests on the 11-metre poles gave a deflection of 10 cm. at the top of the pole within the elastic limit, and 19 cm. before any serious cracks appeared on the pole. This, of course, was with a horizontal pull, which, for the deflection of 19 cm., was approximately 500 kg.

Construction of the Lattice Type of Pole.—The armature is composed of the ordinary round iron bars grouped at the corners. From three to five ⅝-in. bars are bound together, and reduced gradually to two bars at the neck of the pole at each corner. The cross bracings are bent on formers or templates and strung on the pole. Soft iron binding wire is used to keep them in position (see fig. 22).

Four teak wood moulds were made, in order that there should be a continuous output of four 11-metre poles a day.

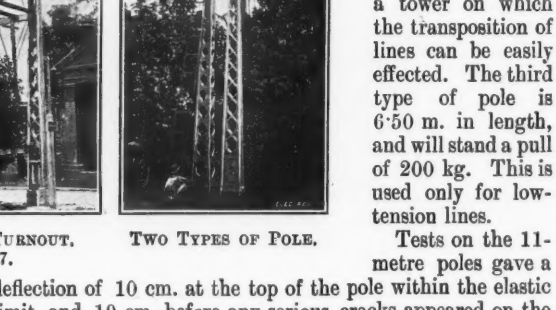


Fig. 28.—Pole Car.

After the ironwork has been completely built up it is placed in the wood mould. The spaces in the poles are made by teak blocks built up in five pieces, tapered so as to receive a tapered wedge in the middle. After the concrete has been run in and allowed to set for 24 hours, the central

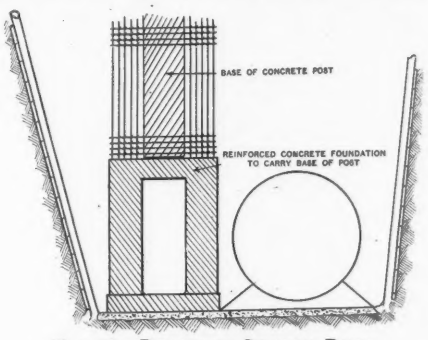


Fig. 29.—Detail of Special Base.

wedge of each hole is pulled out, thus releasing the other tapered pieces of teak. These wedges, as well as the sides of the mould, are kept well greased.

The pole is cast horizontally, and after 24 hours the mould may be entirely removed (see fig. 21, page 691). Already 800 such poles have been made from four moulds.

The cross-section of the pole (fig. 22) shows that the iron is placed so as to give the greatest strength in the direction of the line. The condition of severest strain likely to occur on any of our lines is that due to all the lines between two poles being broken. On certain lines there are as many as 12 conductors—six of 50 mm.^{2} cross-section and six of 35 mm.^{2}. All lines are tensioned up to $7\frac{1}{2}$ kg. per mm.^{2} by dynamometer. Thus in the case of all lines being broken there would be a pull of 3,750 kg. to be distributed along the line.

Siam is fortunately out of the typhoon area, and there is no possibility of ice or sleet forming on the lines; thus there is no serious side pressure to be allowed for. Further, at the frequent road crossings double suspension and either two poles or an extra strong pole is used.

Serious trouble from lightning has been experienced in the past when teak poles were used. For this reason each concrete pole is provided with an iron spike conductor connected metallically through the armature to earth. No earth line, either over or under the conductors, is used, and with these lines no trouble from lightning has been experienced.

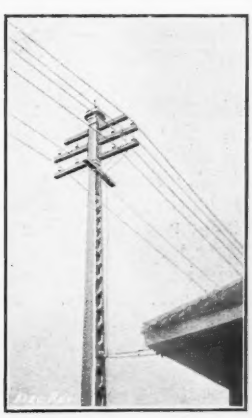
The soft clayey nature of the ground throughout Bangkok, and the fact that it is at an average of only 6 in. above sea level, make the question of foundations for these poles carrying the abnormally heavy lines that they do a special problem. The first few poles were put up on a simple plate of concrete, and part of the base was filled in with concrete and broken brick. This was, however, found to be too costly, and to have too little stability, the whole structure having a tendency to sink.

The following plan has proved comparatively inexpensive, and has completely solved the difficulty. Two $\frac{3}{4}$-in. bars are embedded in the foundation-plate of concrete, which is approximately 3 ft. 6 in. long by 2 ft. 6 in. wide by 5 in. thick, and reinforced with a network of small $\frac{3}{8}$ in. iron bars. The last lattice-work section of the pole is cast solid, and a short 1 in. bar threaded through, leaving 4 in. projecting on either side of the pole (see detail, fig. 26).

The pole is slid into position on this platform on boards placed on the side of the pit, and is held in a vertical position by four ropes. The four projecting bars are bent over the 1 in. bar, and concrete is filled in just to cover them, as shown. The concrete is allowed to set for two or three days before the earth is filled in.

In one particular instance the erection of these poles was complicated by the fact that a large underground culvert 5 ft. in diameter was being constructed at the side of the road and almost in the line where it was necessary to erect one of our most important lines. The top of the culvert almost coincided with the depth at which the base of the pole had to be, and it was first proposed to strengthen the culvert at these points and to form a platform base on the culvert. But as this culvert had already given considerable trouble and was under a different department, it was impossible to obtain permission for this. Consequently the line had to be shifted to a point just clear of the culvert, and foundations were made at the same depth as that for the culvert; from this four pillars, 6 in. × 6 in., were brought up to the desired height, and the platform for the base of the post was constructed on them, as in fig. 29. The armouring was carried continuously through these pillars to the ground level, and the four pillars at this point were made to embrace the base of the post. This is clearly shown in figs. 23-25.

A somewhat similar construction had to be adopted when the line crossed a high railway embankment, and where the ground was very low and swampy on either side of the railway, the pole on either side of the line being gradually raised on these special bases for some four or five spans on either side.



Service Line.

Angle Pole.

Cable Junction.

Fig. 30.

For end sections, termination points, corners and turnouts, a specially strong concrete pole has been made at only a slighly increased cost; it is a square hollow lattice type of pole and is designed to stand a pull at the top of 2,500 kg. (fig. 30).

The foundations for these are usually designed to meet each special case, the shape and position of the plate as well as the underground staging being laid out to suit the resultant pressure on the pole so far as possible; stay wires

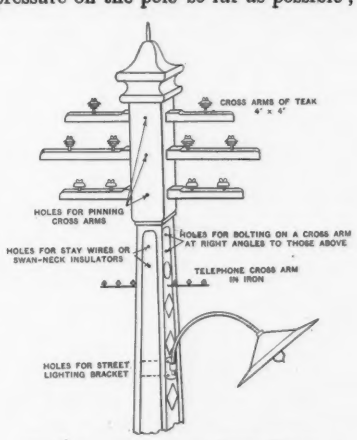

CROSS ARMS OF TEAK 4" x 4"
HOLES FOR PINNING CROSS ARMS
HOLES FOR BOLTING ON A CROSS ARM AT RIGHT ANGLES TO THOSE ABOVE
HOLES FOR STAY WIRES OR SWAN-NECK INSULATORS
TELEPHONE CROSS ARM IN IRON
HOLES FOR STREET LIGHTING BRACKET

Fig. 31.—Detail of Pole Head.

are not used, as it is found that heavy concrete blocks as anchors, &c., bring the cost nearly to that of putting in a strong pole, and, of course, in many cases stay wires cannot be used, as they would interefere with road traffic or private property.

The cross-arms are of teak, 4 in. × 4 in., soaked in Spencer preservative compound. Exception has been taken by some to putting these cross-arms through holes in the concrete poles, as they consider that the teak may rot at these points, and the trouble be unknown until too late. This has not been found to be the case. The cross-arms are easily removed by punching out the ½-in. iron pin (fig. 31).

Mr. P. P. Wheelwright, Chairman, Manchester Section I.E.E.

In the casting of the poles holes have been left to template for tramway cross-arms, swan-neck insulators for small branch lines, brackets for our own telephone lines, and street lighting brackets. The native wiremen work mostly without ladders on these poles, as the lattice work gives excellent foothold. The work of slinging up the lines, fitting insulators, &c., is thus carried out very rapidly.

Transport.—Two types of pole car were made. The first was a four-wheeled car with two bridges and a high arched back axle. From each of the bridges two differential pulley blocks were suspended. The car being backed over the poles as they lay on the ground, slings were passed under the poles and hooked to the pulley blocks and the poles raised to the required height. In practice it was found

Mr. James Lowson, Chairman, Scottish Section I.E.E.

that this four-wheeled car was too long and cumbersome for towing by motor lorry, and when loaded with two poles was too much for some of the bridges.

The other type of pole-car constructed at the same time had only a single pair of iron wheels, 5 ft. in diameter, and a chassis partly of iron and partly of wood, with two bridges. At the centre of each bridge was a long screw terminating in a hook, with a suitable winding lever. This pole-car is comparatively light, and is arranged for towing by motor lorry (fig. 28). At the time of writing about 400 poles have been transported without any difficulty to distances up to 3 miles at the average rate of about 10 poles a day. The structure has to be strong, as this work being completely in the hands of natives, the poles were usually transported at an average speed of 15 miles an hour, and this with rough roads and awkward bridges over the frequent canals.

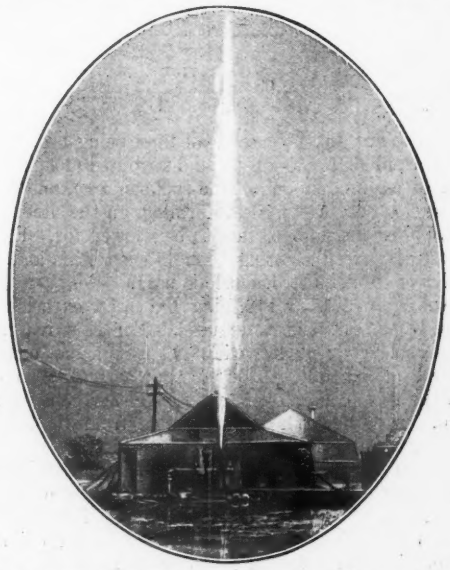
In certain instances where it was impossible to build a

Mr. P. V. Hunter, Chairman, Newcastle Section I.E.E.

transformer house, transformers up to 25 kw. are mounted on the poles, being usually suspended between two poles with channel iron supports.

Street Lighting Posts.—Three or four different types are in use. The drawing, fig. 22, shows one of the smaller types for 100 to 200-c.p. lamps, the largest size being used on the main streets for 1,000-c.p. lamps. Since these are all used in connection with underground cables, they have no great strain to withstand, and are, therefore, cast in two pieces, the top part being a plug fitting into a socket in the base.

It was at first thought desirable to cast these posts ver-



An Australian Water-Power Plant (see p. 695).

tically, in order that the hydrostatic pressure should cause the concrete to set under pressure, and therefore to reduce the height of the filling platform they were made in two parts. The system has answered perfectly, and no weakness whatever has shown at the joint—in fact, it cannot be detected.

The pole is cast hollow with a liner of very thin sheet zinc, which is left in position after casting. The reinforcement is of round iron bars kept in position by a spiral winding. The base is provided with an underground cable entrance and above ground a large door in one side, the

door being of concrete and held in by dogs and a padlock fitting. Pieces of wood are cast in position inside for fixing switches, cable boxes, &c.

In conclusion, I would say that these concrete poles have to withstand a sun radiation temperature of 140° F. during the six months' dry season, and this is followed by six months' wet season. The poles that have been in use for eight years have shown no signs of deteriorating, and retain their clean colour and appearance.

THE I.E.E. LOCAL SECTIONS.

THE proceedings of the Local Sections of the Institution of Electrical Engineers during the session which has just been opened must inevitably be to some extent under the clouds of war. Annual dinners are not to be held, though the President and others from headquarters will make an official visitation of each Section on suitable nights yet to be arranged. The youngest member of the family—the Western Section (Mr. David E. Roberts, chairman)—which has found it difficult enough to secure good meetings in normal sessions, does not expect to gather together at all, with its numbers depleted by war absentees. As our pages last week and this show, several of the chairmen have already delivered their opening addresses to their respective Sections—Mr. P. P. Wheelwright at Manchester, Mr. James Lowson at Glasgow, Dr. A. H. Railing at Birmingham, Mr. P. V. Hunter at Newcastle-on-Tyne, and Mr. Thomas Roles (Yorkshire Section).

Mr. P. P. Wheelwright (Manchester).

Mr. P. P. Wheelwright, who is the chairman of the Manchester Local Section of the I.E.E., and whose opening address appeared in abstract in our last issue, has been on the Committee of that Section for the last three years, during two of which he has occupied the vice-chair. For the greater part of his electrical career his interests have held him to Blackburn, where his pupilage was served under the late Mr. A. S. Giles. Prior to this, Mr. Wheelwright was apprenticed to the Phœnix Electrical and Mechanical Engineering Works at Derby, where he went through the shops, designing and drawing offices, and all the departments of a firm manufacturing engines, generators, and electrical apparatus. After the completion of his period with Mr. Giles, he went for a short time as shift engineer at the Blackpool and Fleetwood Tramroad generating station. From there he returned to Blackburn as a shift engineer, and after five years in that capacity he was appointed assistant mains superintendent; two years later he became mains superintendent, and subsequently chief assistant and deputy engineer. In 1904 he did what, we believe, few other supply engineers have done in this country—became "chief" in the works where many years before he had begun his electricity supply training. As chief electrical engineer and manager, he has since carried out all the extension work, &c., in connection with the Blackburn undertaking, including the addition of some 5,000 KW. of alternating-current plant, and the starting up of a three-phase distribution system at 6,600 volts, with sub-stations necessary for mill-driving, &c. At the present time the Corporation is proceeding, under Mr. Wheelwright's advice and supervision, with the building of a new generating station situated outside the town, such a station having become essential owing to the very rapid increase in the work of the department during the last five years.

Mr. James Lowson, V.D. (Scottish Section).

Mr. James Lowson, V.D., chairman for the current session of the Scottish Local Section of the Institution of Electrical Engineers, was born at Carnoustie, Forfarshire, and educated at the Dundee High School and the Royal Technical College, Glasgow. In 1895 he went into partnership with the late Councillor W. C. Martin, practising as W. C. Martin & Co., of Glasgow and London. The firm have specialised in steamship work and have gained a reputation which is practically world-wide. They have supplied and erected the complete electrical equipment of many of the largest steamships at present afloat, including the *Mauritania*, *Aquitania*, *Transylvania*, *Tuscania*, several well-known Dutch steamers, *Gelvia* and *Turbantia*, the Austrian ship *Kaiser Franz Joseph I.* &c. The firm also carried out an important installation of dock lighting for the Clyde Trust. Mr. Lowson is a member of the Institution of Electrical Engineers; the Institution of Engineers and Shipbuilders in Scotland; the Electrical Contractors' Association; the Merchants' House, Glasgow; the Incorporation of Hammermen, Glasgow; Glasgow Chamber of Commerce, &c. He was for 25 years a member of the 1st Lanark Rifles (now 5th Scottish Rifles), retiring with the rank of Hon. Major. He was presented with the Volunteer decoration in 1910. Mr. Lowson's son, Mr. Norman C. Lowson, B.Sc., has joined the Special Reserve of the Royal Engineers, and is now in the Signal unit serving his country in France.

Mr. P. V. Hunter (Newcastle Section).

Mr. P. V. Hunter, the chairman of the Newcastle Section, has been for the past five years chief of the electrical department of Messrs. Merz & McLellan. He entered Faraday House in 1900, and after a successful period as a student there, he went to Messrs. Willans & Robinson, Ltd., for mechanical training, and subsequently began his electric supply experience in connection with the Yarmouth municipal undertaking. In 1903 he joined the staff of Messrs. Robert Hammond & Son, and later became assistant clerk of works during the construction of the Mansfield Corporation Electricity Works; he occupied a similar position with the Hackney Borough Council when it was extending its supply network. He first joined Messrs. Merz & McLellan in 1904, and about five years later took up the position that he now occupies with them. Since that date many large and important electrical engineering matters have passed through the firm's hands, including extensions at Carville power station, the building of Dunston power station, the laying of a complete system (200 to 300 miles) of 20,000-volt underground cables and overhead lines in Northumberland and Durham, the equipment of a number of waste heat and gas power stations, the electrification of the Melbourne suburban railways, and the Central Argentine and Buenos Ayres Western Railways, the installation of a 15,000-KW. turbo-alternator at Lot's Road, and the installation of the 25,000-KW. turbo-alternator for Chicago. Mr. Hunter is the inventor of the split conductor protective system, and of the "Repellant Arc" high power switch

Mr. Thomas Roles (Yorkshire Section).

Mr. Thomas Roles, who is chairman of the Yorkshire Local Section, entered the Institution as an associate member in 1901. Since 1912 he has been a member of the Local Committee. Some references to his career appeared in the ELECTRICAL REVIEW for June 19th, 1914. He is, of course, city electrical engineer and manager of Bradford.

AN AUSTRALIAN WATER POWER PLANT.

WE are well accustomed to the utilisation of water-power in large hydro-electric installations in the United States, Scandinavia, Canada, and elsewhere, but the station which we illustrate on page 694 is probably unique, as showing a reversal of the ordinary procedure. It is to be found at Thayo-mindah, Queensland, Australia, and was erected in 1895 under the authority of the Balloo Shire Council, in order to provide electric lighting in the vicinity. By the courtesy of Mr. G. A. Lewis, the engineer to the installation, we are able to give a few particulars of it.

A most interesting point is that the water-power is derived from an artesian bore well, which has a certified pressure when shut down of 270 lb. per sq. in., and a working pressure of 190 lb. per sq. in. when the jet is playing on a Leffel water wheel. In the illustration the power of the jet is shown by the column of water which is being allowed to escape. This source of power is being utilised to drive two dynamos, each of 10-KW. capacity, which supply current to a D.C. two-wire system comprising 80 50-C.P. metal-filament lamps, the number of consumers being 25, and the voltage at consumers' terminals 200 volts. There is no electricity supply for power purposes, and there is no gas in the neighbourhood, so that the price which is charged for lighting, namely, 1s. per week for each light, may be reckoned, under the circumstances, as a very reasonable and simple tariff.

On the Pounce.—The following extracts are taken from an outburst entitled: "While Europe Fights, America Prospers." By Herbert Kaufman, in a Chicago paper:—

It's here! Your chance has come. Half the world had to be blown off the map to produce the opportunity. More billions of pounds, francs and marks' worth of assets than the total created wealth of the world five hundred years ago had to be smashed to smithereens . . . to arrange matters for your benefit, but at all events you are one of the residuary legatees of the still vast, valid estate.

Now make good—you're nailed. We've always suspected you, but you were so confoundedly plausible with your excuses—so clever with your explanations of how you just missed it, that we gave you the benefit of the doubt and—another try. But you won't "get by" again, unless you produce the goods. . . . This is not an urge to capitalise our neighbours' woes. On the contrary, it is a suggestion to get busy and lighten them. The more we help ourselves, the quicker we analyse the situation and sensibly set about relieving the world-strain, the sooner we repair the universal tears and snags and patch up the broken machinery—the better off everybody will be. . . . . Shed a tear in the name of decency and humanity over the appalling tragedy, but in the name of good citizenship and good sense, simultaneously help devastated lands and your own country by spreading cheer among the blinded doubters whose pessimism is retarding a necessary and immediate boom.

By every law of logic and profit there shouldn't be a still wheel or a clean smoke stack on the whole Continent. By raising our production to its maximum limits, we can not only create enormous fortunes for ourselves, but at the same time so reduce costs that we can also lighten the misfortunes of our kinsmen yonder. History won't repeat the present performance in your lifetime. It's your best axe and biggest chance.

The spectacle of Mr. Kaufman pausing one second to shed a tear before he hurls himself upon the vested interests and established goodwill of the contending parties and prepares to create enormous fortunes "for ourselves" (*i.e.*, U.S.), if adequately portrayed would be worthy to rank with that immortal masterpiece, "George Washington Trying to Tell a Lie." Do our American cousins really relish these effusions? Or do they not rather feel uncomfortable when they see one of their compatriots (of German origin, too) prancing on his hind legs and whirling his arms in print in this undignified fashion?

CONTRACTS OPEN and CLOSED.

(*Continued from page* 690.)

Spain.—Tenders have just been invited for the concession for the electric lighting of the town of Guadacanal (province of Seville) during a period of ten years; for the concession for the town of Palenzuela (province of Palencia) for six years; and for the town of Engera (province of Valencia) for four years.

November 27th. Tenders are being invited by the municipal authorities of Molina (province of Guadalajara) for the concession for the electric lighting of the town during a period of ten years.

November 28th. Tenders are being invited by the municipal authorities of Igualada (province of Barcelona) for the concession for the electric lighting of the town during a period of 10 years.

December 1st. The municipal authorities of Albuera (province of Badajoz) are inviting tenders until December 1st, for the concession for the electric lighting of the town during a period of six years.

Stockton-on-Tees. — November 20th. Corporation. Paper-insulated, lead-covered and armoured cables. See "Official Notices" November 13th.

South Africa.—December 17th. Five electric bed lifts for the Alexandra Hospital. Tenders to the Chairman of Tender Board, Provincial Auditor's Office, Cape Town. A specification and blue prints can be seen at the Board of Trade (C.I. Dept.) in London.

Wakefield.—December 4th. Yorkshire (W.R.) Electric Tramways Co., Ltd. Twelve months' supply of electric lamps, fittings, insulating materials, &c. Schedules can be obtained from the Central Offices, Belle Isle.

Walsall.—December 8th. Corporation. Six 250-KW. and one 500-KW. rotary converter equipments. See "Official Notices" to-day.

Wigan.—November 23rd. Uniform clothing for tramway men. Mr. Frank Buckley, General Manager.

Winchester. — December 17th. Corporation. One 500-KW., D.C. turbo-generator, with condensing plant, pipework, &c. See "Official Notices" to-day.

CLOSED.

Australia.—The following tenders have been accepted :—

P.M.G.'s Department, Victoria.—
Six miles paper-insulated cable, £144.—Callender's Cable and Construction Co., Ltd.

P.M.G.'s Department, South Australia.—
25 tons G.I. wire, £10 17s. 6d. per ton; 3 tons tie wire, £15 5s. per ton.—Rabone, Felz & Co.

Victorian Railways Department.—
Bessemer steel tram rails, £8 3s. 2d. per ton.—Elders Metal and Mercantile Pty., Ltd.
Vulcanised rubber E.L. wire, £14 8s. per mile.—B.I. & Helsby Cables, Ltd.

Sydney Municipal Council.—
Three 2,000-K.V.A. 33,000-5,000-volt transformers, £1,699 each.—Australian G.E. Co.
300 Nitro lamps, £2,197 10s.; 100 750-watt Nitro lamps, £732 10s.—Aust. G.E. Co. —*Tenders.*

Dorset.—The Electrical Apparatus Co., Ltd., has received the renewal of the contract for meters for 12 months to the County of Dorset Supply Co.

London.—The following tenders have been received by the London Education Committee for installing electric lighting at three schools :—

	The "Victoria," Hammersmith.	Woolmore Street, Poplar.	Senior Street, Paddington.
Defries & Goldman (accepted)	£470	£210	£375
T. W. Vaughan & Co. (1914), Ltd.	319	200	409
Lawrence & Redman	325	254	—
Foote & Milne, Ltd.	334	283	500
J. & F. May	339	282	—
H. J. Cash & Co.	339	277	402
Kent & Co.	349	277	—
Tyler Apparatus Co., Ltd. ..	355	291	—
Smeeton & Page	370	287	—
Alpha Mfg. Co., Ltd.	381	250	—
G. Weston & Sons, Ltd.	395	320	444
Electra, Ltd.	405	349	—
Napier Kimber, Ltd.	—	274	—
Marryat & Place	—	402	—
A. Hawkins & Sons	—	—	419
R. H. & J. Pearson	—	—	479
Arthur Newman	—	—	484
S. G. Cozens	—	—	5.6

L.C.C.—The Highways Committee recommends that the reserve supply of coal for the Greenwich generating station be increased by 10,000 tons, and that the offer of Messrs. W. Cory & Sons, Ltd. (the present contractors), be accepted to supply the additional 10,000 tons of coal at the contract price, with an extra 1s. a ton to cover war risks. The company agrees to unload and stack the coal at the Purfleet wharf for a period of 12 months, and to reload the coal into barges and deliver to the Greenwich generating station as required by the Council at an additional sum of 4s. per ton. It is proposed that the Council shall have the option during the next 12 months of extending the arrangement for a further period of six years at such terms as may be agreed.

BERMONDSEY.—The Electricity Committee of the Borough Council has accepted the tender of the Bell's United Asbestos Co., Ltd., to supply 1,050 solid seamless asbestos gaskets, at 6s. 6d. per lb.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

OFFICE OF WORKS.

Rewiring, 11 and 12, Downing Street.—H. J. Cash & Co.

POST OFFICE.

Protective apparatus.—Siemens Bros. & Co., Ltd.
Telegraphic apparatus.—Creed Bille & Co., Ltd.; Gell Telegraphic Syndicate, Ltd.
Telephonic apparatus.—B. I. & Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co.; General Electric Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Phœnix Telegraph and Electric Wire; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Telephone cable.—Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; London Electric Wire Co. & Smiths, Ltd; C. Macintosh & Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.
Copper wire.—London Electric Wire Co. & Smiths, Ltd.
Galvanised iron.—Rylands Bros., Ltd.; F. Smith & Co.; Wire Manufacturers, Ltd.
Laying line of stoneware ducts, steel tubes and cast-iron pipes, Birmingham-Sheffield.—Section I: T. Lowe & Sons.
Laying line of stoneware ducts, Birmingham-Sheffield.—Section III: T. Lowe & Sons.
Laying line of cast-iron pipes, Chichester.—O. C. Summers.
Laying lines of stoneware ducts and cast-iron pipes, Eastbourne.—W. L. Wallis & Co.; London—Sevenoaks, Section III.—J. Mowlem & Co.; Luton—St. Albans.—G. Powdrell; Thornaby—Stockton.—W. Irwin & Co., Ltd.
Manufacturing, supplying, drawing-in and jointing lead-covered cables. — Birmingham — Sheffield, Johnson & Phillips; Chelmsford—Colchester, Siemens Bros. & Co., Ltd.; Edinburgh—Forth Bridge, Siemens Bros. & Co., Ltd.; Glasgow—Kilmarnock, Siemens Bros. & Co., Ltd.; Liverpool—Ormskirk, B.I. & Helsby Cables, Ltd.; London—Sevenoaks, W. T. Henley's Telegraph Works Co., Ltd.; Luton—St. Albans—W. T. Henley's Telegraph Works Co., Ltd.; Oldham—Halifax, Western Electric Co., Ltd.; Ormskirk—Southport, B.I. & Helsby Cables, Ltd.
Supplying and installing electric lift, Belfast P.O.—J. McLean and Sons.
Telephone Exchange equipment, Darlaston P.O.—Western Electric Co., Ltd.
Telephone Exchange equipment, Merthyr Tydvil.—Western Electric Co.
Telephone Exchange equipment, Ryde P.O.—Peel-Conner Telephone Works, Ltd.
Telephone Exchange equipment extension, Sale.—Peel-Conner Telephone Works, Ltd.
Wiring for electric light, &c.—Birmingham P.O. Factory; Grindlay, Ross & Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Insulators W.P.—Bullers, Ltd.
Telegraph material.—Bullers, Ltd.
Telephones.—British L.M. Ericsson Manufacturing Co., Ltd.
Bronze wire.—Shropshire Iron Co., Ltd.
Copper wire.—Shropshire Iron Co., Ltd.
Galvanized iron wire.—Ry lands Bros., Ltd.

INDIA OFFICE STORE DEPARTMENT.

Accumulators.—J. Stone & Co., Ltd.
Apparatus.—Elliott Bros.
Cable.—Peel-Conner Telephone Works; Siemens Bros. & Co., Ltd.
Ebonite.—India-Rubber, G.P. & Telegraph Works Co., Ltd.
Spare parts of electric plant.—Siemens Bros. Dynamo Works.
Switchboard.—Peel-Conner Telephone Works.
Switchgear.—Eckstein, Heap & Co.
Turbines.—Lancashire Dynamo Co.

Loftus.—The U.D.C. has accepted the tender of Messrs. Cox-Walkers, of Darlington, for the electric installation at the Council Chamber.

Ruthin and Marlboro'.—The tenders of the Premier Accumulator Co., Ltd., have been accepted for the supply of batteries for both of these electricity works.

Taunton.—The T.C. has accepted the tender of Messrs. Cory Bros., Ltd., for from 2,000 to 3,000 tons of coal (Russell's new black vein washed beans), for the electricity works, at 17s. 3d. per ton.

Tunbridge Wells.—The Lighting Committee recommends the tender of the Western Electric Co., Ltd., for cables for a period of three years, for acceptance.

Woolwich. — The B.C. Electricity Committee has accepted the following tenders :—

Two lift pumps, £127.—Messrs. Gwynnes.
Two feed water tanks, £46.—Harvey & Co.
Rolled-steel joists for the 3,000 KW. set, £21 15s.—Measures Bros.
One meter and two feeder panels, £236.—Ferguson, Pailin & Co.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, November 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Effect of Vacuum on Steam Turbines," by Mr. G. G. Stoney, F.R.S.; Thomas Hawksley lecture on Pumping and other Machinery for Waterworks and Drainage.

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, November 21st. At 7.15 p.m. At Bolbec Hall, Westgate Road, Newcastle-on-Tyne. Paper on "Lighthouses and Lightships," by Mr. C. Suckan.

Faraday Society. Monday, November 23rd. At 8 p.m. At Rooms of Chemical Society, Burlington House, Piccadilly, W. President's address by Sir R. Hadfield, F.R.S.

Royal Society of Arts.—Wednesday, November 25th. At 8 p.m. At John Street, Adelphi. Paper on "The Supply of Chemicals to Great Britain and her Dependencies," by Sir W. A. Tilden F.R.S.

Greenock Electrical Society.—Thursday, November 26th. At 7.45 p.m. At Masonic Rooms, 21, West Stewart Street. Papers on "The Oscillograph," and "The Gyroscope and Gyroscopic Control," by J. A. Kinnaird.

Institution of Electrical Engineers. Thursday, November 26th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

(Birmingham Local Section).—Wednesday, November 25th. At 7.30 p.m. At the University, Edmund Street. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

Physical Society. Friday, November 27th. At 5 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "Notes on the Conduction of Electricity at Point Contacts," by Mr. A. F. Hallimond, and "Thermal Conductivity of Badly Conducting Solids," by Mr. T. Barratt.

Junior Institution of Engineers.—Friday, November 27th. At 8 p.m. At 31 Victoria Street, S.W. Paper on "A Model Drawing Office System," by Mr. C. E. Ford.

Association of Mining Electrical Engineers (Lancashire, Cheshire and North Staffordshire Branch). Saturday, November 28th. At 3.30 p.m. At Wigan Mining and Technical School. Joint meeting with the Colliery Managers' Association (Lancashire Branch).

Association of Supervising Electricians.—Saturday, November 28th. At 6.30 p.m. At London Tavern. Inaugural Dinner.

NOTES.

Institution and Lecture Notes.—Greenock Electrical Society.—The syllabus of the above Society for the Session 1914-15 includes:—

1914.—November 26th.—"The Oscillograph," "The Gyroscope and Gyroscopic Control," by J. Aitken Kinnaird.
December 5th.—Visit to Coplawhill Car Works and sub-station of the Glasgow Tramways.
" 10th.—"The Electrical Equipment of a Liner," by J. E. Allan.
" 24th.—Social Meeting.
1915.—January 7th.—"Developments in the Electrical Industry," by D. McDougall.
" 14th.—Visit to Babcock & Wilcox's Works, Renfrew.
" 21st.—"Electricity in a Shipbuilding Yard," by D. Angus.
February 4th.—"Illumination," by F. B. Humphriss.
" 13th.—Visit to Royal Technical College, Glasgow.
" 18th.—"Diesel Engine Testing and Running," by J. Richardson.
March 4th.—"The Operation of a Large Electric Supply System." by G. Macdonald.
" 13th.—Visit to Mavor & Coulson's Works, Glasgow.
" 18th.—"Suction Gas Plant," by E. P. Duckworth. General Meeting.
April 2nd.—Social Meeting.

Royal Society of Arts.—The opening meeting of the Session was held on Wednesday evening, when an address was delivered by Colonel Sir Thomas H. Holdich, R.E.

Among the papers to be read before Christmas are:—

Wednesday evenings, at 8 o'clock:—
November 25th.—Sir W. A. Tilden, D.Sc., F.R.S., F.C.S., "The Supply of Chemicals to Britain and her Dependencies."
December 2nd.—W. R. Ormandy, D.Sc., F.C.S., "Britain and Germany in Relation to the Chemical Trade."

The following papers are to be read after Christmas:—

Thomas Worthington, "The Work of the Commercial Intelligence Branch of the Board of Trade."
T. Thorne Baker, "The Industrial Uses of Radium."
G. W. Hulme, "Patent Law."
W. T. Thornton, "The Industrial Uses of Coal Gas."
J. A. Hunter, "The Textile Industries of Germany and of Great Britain."
Dr. F. Mollwo Perkin, "Oils, their Production and Manufacture." Three lectures, January 18th, 25th, February 1st.
M. H. Baillie Scott, "House Building—Past and Present." Three lectures, March 15th, 22nd, 29th.
Prof. Vivian B. Lewes, "Motor Fuel." Three Fothergill Lectures, February 15th, 22nd, March 1st.

Institution of Electrical Engineers.—According to the programme of the YORKSHIRE LOCAL SECTION for the Session just commencing, general meetings will be held at the Philosophical Hall, Leeds, on the following dates:—December 2nd, January 13th, February 10th, March 10th, April 14th. Annual General Meeting May 12th.

At the meeting on November 17th Mr. C. J. Beaver read his paper on "Cables" before the MANCHESTER LOCAL SECTION. The discussion was closed.

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday last, the Chairman, Dr. A. H. Railing, delivered his inaugural address.

Royal Society.—The following awards have been made by the President and Council:—The Copley Medal to Sir Joseph Thomson, O.M., F.R.S., for his discoveries in physical science. The Rumford Medal to Lord Rayleigh, O.M., F.R.S., for his numerous researches in optics. The Hughes Medal to Prof. John S. Townsend, F.R.S., for his researches on electric behaviour of gases.

Physical Society of London.—The Council has decided not to hold an exhibition of apparatus during the present Session.

Junior Institution of Engineers.—At a recent meeting Mr. F. D. Evans, A.M.Inst.C.E., Executive Engineer, Public Works Department, Federated Malay States, discoursed on the topic "The Engineer and Malaria." He said that the most certain way of getting rid of mosquitoes was to do away with all water containing refuse in vessels, or properly to screen in or close such vessels, and thoroughly drain land. It was most necessary for engineers carefully to consider the probable effects of malaria on the labour force to be employed on any new work in a malarious country, and to employ what precautionary measures were practicable, as otherwise they might be faced with an appalling death and wastage rate when the work was in progress.

Royal Institution.—The Eighty-Ninth Christmas Course of Juvenile Lectures will be delivered this year by Prof. C. V. Boys, F.R.S., his title being "Science in the Home." The lectures will be experimentally illustrated, and the subjects are as follows:—"Mechanics in the Home," Tuesday, December 29th; "Chemistry in the Home," Thursday, December 31st; "Fluids in the Home," Saturday, January 2nd; "Heat in the Home," Tuesday, January 5th; "Electricity in the Home," Thursday, January 7th; "Light in the Home," Saturday, January 9th. The lecture hour is 3 o'clock.

Victorian Institute of Electrical Engineers.—The Institute has decided to admit as full members persons under 30 years of age, who are only eligible as associates. The maximum age of students has been fixed at 25, instead of 23.

Association of Supervising Electricians.—At a meeting on the 10th inst., a paper was read by Mr. H. C. E. Jacoby on "A.C. Commutators." The hon. sec. announced that the next paper, on "Wiring Systems," would be read on December 15th, and also drew attention to the inaugural dinner to be held on the 28th inst. By the courtesy of the Central London Railway Co., the members of the above Association paid a visit to the Paddington-Bakerloo Station to examine the working of the escalators, the whole of the apparatus being thoroughly explained by their inspector, Mr. Lindsay. Afterwards the company conveyed the members to Edgware Road Station to examine the Ozonair plant. The visit proved most interesting and instructive.

Birmingham and District Electric Club.—On Saturday last a paper on gas turbines was read by Mr. W. Fennell, who stated that a great amount of experimental work was being carried out.

Illuminating Engineering Society.—On Tuesday, December 1st, at the House of the Royal Society of Arts, John Street, Adelphi, W., a discussion on "Illuminating Engineering in War Time: Some Lessons to be Learned from the Present Lighting of London," will be opened by Mr. Leon Gaster.

Association of Mining Electrical Engineers.—At a meeting of the WEST OF SCOTLAND BRANCH last week, Mr. L. G. F. Routledge read a paper on "Power Factor and Its Improvement." A paper on "Rock Drills," by Mr. C. E. Hart, was also discussed.

Inside Out.—The Appeal Court has, this week, been called upon to consider a decision of a Metropolitan magistrate to the effect that the top-covered compartment of a tramcar is really the inside as much as the inside under the Acts. The Court has turned the decision of the said magistrate inside out, or upside down, by ruling that the outside is the outside none the less because the putting of a top-cover on the outside makes it an inside. This being so, it was perfectly right to summon a conductor who allowed overcrowding on the top-deck. Really, to more simple-minded creatures than magistrates, it does seem strange that it should have been necessary to trouble the Court of Appeal with the problem of whether and when a top-deck ceases to be a top-deck.

Hughes Induction Balance in Surgery.—In a note communicated to the Académie des Sciences, Mr. G. Lippmann draws attention to the utility of the Hughes induction balance for locating metal in military surgery. The balance consists of a battery and interrupter, in series with two primary coils, on which are wound secondary coils connected in series with a telephone; the leads are crossed, and the coils are exactly alike, so that normally their effects are exactly neutralised, and no sound is heard in the telephone. When, however, a metallic body is placed near one of the coils, the eddy currents induced in the metal react upon the coil and disturb the balance, so that a sound is heard in the telephone. When the metal is magnetic, as in the case of splinters of shell or German bullets, the effect is much increased. Thus the device can be used to indicate the presence, and to some extent the nature, of a metallic body, and its approximate position.

Fatality.—ROTHERHAM.—A Sheffield paper reports that a motor attendant named Hopkinson, 18, met with his death at the Rotherham Main Colliery. He was engaged in the wash-house at the coke ovens, when an electric wire fused and ignited a bucket of benzol. Hopkinson got hold of the bucket to pull it away from the switchboard, and his clothing caught fire. He was severely burnt, and was removed to the Rotherham Hospital, where he died.

For Sale.—The Shropshire, Worcestershire and Staffordshire Electric Power Co., Downing Street, Smethwick, invite offers for eight motors, suitable for 200 v. 50 amps. two-phase supply system, also three spare rotors. Particulars are given in our advertisement pages to-day.

Appointments Vacant.—Junior assistant electrical engineers (15s.), for Newcastle-on-Tyne Electric Supply Co.; fitter driver (35s.), for Sevenoaks and District Electricity Co.

Definition of Consumer's Terminals.—A correspondent, who has had occasion to investigate the application of the Board of Trade Regulations to service lines, writes indignantly complaining that the Board is unable or unwilling to interpret its own rules. We understand that he sent a diagram of his installation, which we reproduce in outline, to the Board with the following questions:—

Is A the consumer's terminal box, or is it the Corporation's cut-out?

Is A for the protection of the undertaker's mains?

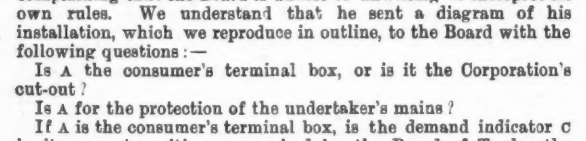
If A is the consumer's terminal box, is the demand indicator C in its correct position as required by the Board of Trade; the maximum demand indicator being the property of the Corporation, and used by them solely for their own purpose?

D. Would this switch be the point at which undertaker's service terminates? if not, where does undertaker's service terminate?

Consumer's main fuse.—Is this for the protection of consumer's house?

His own reading of the rules is that A is the Corporation's cut-out; that according to the rules C may only be placed on the undertaker's side of consumer's terminals, and that the position of this, therefore, governs the point of consumer's terminals, *i.e.*, switch D.

The Corporation's electrical engineer maintained that A was the consumer's terminal box, and that C was in its correct position, *i.e.*, in accordance with the Board of Trade's rules and regulations.



We may add that in addition to the Corporation cut-out shown, there is no other cut-out on the service, and the meter and indicator are the property of the Corporation.

The reply of the Board of Trade was a suggestion that our correspondent should consult his legal and technical advisers with regard to the questions raised.

Reference to the Board of Trade regulations has not enabled us to decide where the service terminates and the consumer's installation begins. Regulation No. 26 states that a sealed safety fuse must be inserted in each service line within a consumer's premises as close as possible to the point of entry; clearly, therefore, the meter and indicator cannot be fixed on the Corporation side of the cut-out A. Nevertheless, it is provided that such instruments must be between the mains of the undertakers and the consumer's terminals. We understand that the Corporation engineer absolutely prohibits a main fuse for a private house other than the main cut-out which the Corporation seals and controls. Is not this requirement *ultra vires*?

We should be glad if our supply station readers would give us an authoritative decision on the points raised.

National Relief Fund.—In aid of the Prince of Wales's Fund, Messrs. Raphael Tuck & Sons, Ltd., are about to issue a "National Christmas Card," which will be sold entirely for the benefit of the Fund. A picturesque group of "Defenders of the Empire," in colours, appears on the cover, and a view of a Dreadnought saluting Nelson's *Victory* inside. It is an artistic and appropriate production, and should prove a popular means of adding to the Fund.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Swinton and Pendlebury District Council has increased the salary of MR. BUSBRIDGE, electrical engineer, to £200, as from December 1st.

On the occasion of his marriage to Miss Elith May Gregory, of Barnstaple, MR. JOHN JAMES HERITAGE, of the Coventry Corporation electricity staff, has been presented by his colleagues with a silver tea-set.

Having received another appointment, MR. ARTHUR COVENEY, manager of the Erith U.D.C. tramways and chief engineer at the E.L. works, has resigned.

MR. F. RILEY, power station superintendent at the Rawtenstall electricity works, has been appointed resident engineer to the new Whalley Asylum, at a salary of £275 per annum. There were 470 applicants. Mr. Riley has been with the Rawtenstall Corporation five years, and was previously with the Stalybridge Joint Board, Ashton-under-Lyne Corporation, Blackburn Corporation, and Lancashire United Tramways in their power stations.

General.—MR. P. WALTER D'ALTON, M.Inst.C.E., M.I.Mech.E., M.I.E.E., than whom there are few more widely known and more highly esteemed in the electrical engineering world to-day, has left Messrs. Dick, Kerr & Co., Ltd., with the entire sympathies of the directors, and has opened offices at Cross Keys House, 56-58, Moorgate Street, London, E.C. (Telephone No. 1055 London Wall), where he will practise as a consulting and inspecting engineer. It has been our privilege to know Mr. d'Alton personally for very many years; indeed, his direct connection with electrical affairs dates back to as long ago as 1889, when he joined Mr. S. Z. de Ferranti, taking charge for him of the Deptford 10,000-volt undertaking. Earlier than that, however, he was actively engaged in engineering work of what in those days was as daring a kind in the marine sphere as Mr. Ferranti's proposals were in the electrical, for after being trained as a marine and mechanical engineer with Messrs. R & W. Hawthorne on Tyneside and under the late Sir William White, his engineering godfather and great friend, he spent several years in submarine work under Mr. Thorsten Nordenfelt from 1886 onwards. It may be remembered that the first of the Nordenfelts was built for the Greek Government, her capabilities being demonstrated in the Gulf of Salamis. The second and third boats were built for the Turkish Government, by which they were taken over after exhaustive experiments in the Golden Horn and the Sea of Marmora. Mr. d'Alton was wrecked in the last of the four Nordenfelt submarines, a boat of 300 tons displacement, and having main engines of 1,500 H.P., off the coast of Jutland, while on a voyage to Kronstadt, for delivery to the Russian Government which, after experiments and demonstrations at Spithead, in the Solent and in the English Channel, had bought her. It was in 1889 when Mr. Ferranti was in need of efficient assistance that circumstances brought Mr. d'Alton into touch with him, and if the truth were told the experience under water doubtless was not without its influence upon the mind of the high-tension pioneer of Deptford when operations calling for courage, initiative and persistency were under consideration. In 1892 Mr. d'Alton succeeded Mr. Ferranti as engineer-in-chief of the London Electric Supply Corporation, Ltd., and occupied that position until the year 1900. We were then engaged in the South African war, and for the greater part of that year Mr. d'Alton was at Aldershot in reserve with the 6th Battalion of the Royal Irish Rifles, with the rank of Major. He has at various times served with the Yeomanry, Volunteers, Territorials and Regulars, retiring, at the end of 1910, when Second-in-Command of the "London Irish," with the rank of Lieut.-Colonel. On the disembodiment of the (Louth Militia) 6th Royal Irish Rifles at the end of 1900, he became engineer-in-chief of the Central London Railway, and two years later he relinquished that office in order to join Messrs. Dick, Kerr & Co., Ltd., taking charge of the very important work connected with the electrification of the Lancashire and Yorkshire Railway. While thus engaged he was also chief mechanical engineer for the same firm, and in that capacity he had through his hands much noteworthy engineering work for abroad (Holland, Spain, Portugal, Egypt, &c.), and especially work of a pioneering character in South America. From the foregoing it will be apparent that Mr. d'Alton has had an exceptionally wide and varied experience, and in his new operations he will bring abilities of a very high order to bear upon civil, electrical and mechanical engineering work. He will make a special feature of representation work in connection with all departments of engineering in Russia, where British manufacturers are justified in expecting to be called upon to execute engineering works and requirements on a very large scale after the war is over. We are sure that Mr. d'Alton's host of friends will join with us in wishing him that measure of success which his genial nature, unvarying courtesy, tactfulness and unique experience as an engineer, and as a man of affairs, so fully deserve.

After an absence of 12 months, MR. C. HIGHAM has been re-elected a member of the Blackburn Town Council. On Mr. Higham's retirement MR. ALDERMAN A. NUTTALL, J.P., was appointed vice-chairman of the Electricity and Tramways Committee in his stead. The latter has now relinquished the post in order to allow Mr. Higham to take over his former position. ALDERMAN W. THOMPSON, chairman of the Electricity and Tramways Committee, has been appointed Mayor of the Borough.

The new chairman and deputy-chairman of the Leeds Corporation Tramways and Electricity Committee are ALDERMAN SMITHSON and ALDERMAN J. BROWN. The chairman and deputy-chairman of the Street Lighting Committee are COUNCILLOR WATSON and ALDERMAN THAXTON.

The new chairman and deputy-chairman of the Bradford Corporation Electricity Committee are MESSRS. J. HALEY and J. HOYLE. The chairman and deputy-chairman of the Tramways Committee are MESSRS. E. PRIESTLEY and S. NEUMANN.

The *Commonwealth Engineer* for October 1st contains the following news of the movements of Australian electrical men:—MR. S. B. COX, of the Sydney staff of the Australian General Electric Co., returned by the ss. *Niagara* last month from a seven months' holiday tour, covering Europe, the United Kingdom, and the United States of America. MR. EDWARD HIRST, managing director of the British General Electric Co., Ltd., returned to Sydney last month after a short visit to Europe. MR. NORMAN NEVILLE, who has been with the Union Electric Co. of Australia, Ltd., for the past three years, left for London, *via* America, by the ss. *Sonoma* on September 26th, for the purpose of arranging British sources of supply for the company's Australian business.

Alderman A. G. Ellaway has retired from the chairmanship of the Birmingham Electric Supply Committee, which he has held for several years. He is succeeded by ALDERMAN A. R. JEPHCOTT, who joined the Committee upon its formation 10 years ago.

Mr. Geo. S. Helme, A.M.I.E.E., who is at present representative in Scotland for the Electrical Co., Ltd., has resigned his appointment with that company as from the end of the present year.

Obituary.—Mr. Augustus Stroh.—We much regret to record the death of Mr. Augustus Stroh, which took place on November 2nd, at his residence at Haverstock Hill. The deceased gentleman was in his 87th year. An account of his career, together with a photograph taken by himself, appears in *Engineering* for Friday last. John Matthias Augustus Stroh was born at Frankfort-on-Main in May, 1828, where he served an apprenticeship in the clock and watch-making trade. His aptitude and skill in this class of work proved to be remarkable, and eventually gained for him the titular distinction (amongst his friends) of "the Prince of Mechanicians." In 1851 (the year of the Great Exhibition) he became a resident in England, becoming a naturalised British subject in 1869. Mr. Stroh was from the earliest times closely associated with the late Sir Charles Wheatstone, and it is not too much to say that the inventions which developed in the fertile brain of that distinguished physicist owed their partial development to the mechanical genius of Mr. Stroh. Of the ingenuity and skill of Mr. Stroh in devising what were practically entirely new mechanical devices and movements, is now known only to a few, but those who know can never forget the "prettiness" of some of the devices invented by him. The mechanism of the "A. B. C." instrument (although this form of apparatus has almost entirely now gone out of use), was alone a model of mechanical skill, whilst the "Wheatstone Automatic system," which, although first devised many years ago, still survives and flourishes, is an enduring monument of both Wheatstone's and Stroh's genius, Mr. Stroh being awarded a gold medal for the same at the Paris Exhibition of 1878. Amongst other inventions Mr. Stroh, in conjunction with Sir Chas. Wheatstone, introduced a new system of magneto-electric clocks, which, although no longer in use, were, in their design and principle, of very great ingenuity. In 1860 Mr. Stroh established in Tolmer's Square a factory for the manufacture of the Wheatstone and Stroh instruments and for developing his other inventions. These works were taken over by the General Post Office in 1880, when he retired from active commercial work. When the first phonograph was introduced into England by the late Sir W. H. Preece, Mr. Stroh produced an instrument of very perfect construction, the motor and moving parts being absolutely silent, and the speed perfectly uniform. Mr. Stroh designed and constructed a series of extremely beautiful instruments by which he repeated in air Prof. Bjerknes's experiments in liquids on the attraction and repulsion due to vibrations, which were described in the Electrical Review at the time. He was most successful as a photographer and produced beautiful work in portraiture and in landscape, in stereoscopic and colour photography. Mr. Stroh was a member of the Institution of Electrical Engineers (of which he was a member of Council for several years), of the Royal Institution, the Physical Society, and of the Société Internationale des Electriciens of Paris, and he was a juror for a number of International Exhibitions. One of his latest inventions, based no doubt on the phonograph, was the violin known to musicians as the "Stroh Violin," which was unlike, say, a "Strad," as could well be imagined. The body consisted of a cylindrical rod, with an ordinary neck and finger-board at one end, the tail piece and chin rest at the other, with the bridge and four strings as on a violin. The vibrations of the strings were conveyed by means of the bridge, which rested upon a rocking or bell-crank lever, to a diaphragm to which was attached a trumpet or resonator underneath the body, which latter was in no way employed for sound purposes. The diaphragm represented the vibrating belly of an ordinary violin, and when the strings were set in motion the rocking lever transmitted the vibrations to the diaphragm, which, in turn, set in motion the air contained in the resonator, and a great volume of sound resulted. The mechanism was simplicity itself, could never get out of order, and was practically indestructible, but the peculiarly metallic timbre of the instrument, so far as we are aware, could never be entirely eliminated.

Will.—The late Mr. Robert Kaye Gray, past president of the Institution of Electrical Engineers, and managing director of the India Rubber, Gutta-Percha and Telegraph Works Co., Ltd., who passed away in April last, left £62,959 gross and £45,870 net personalty.

NEW COMPANIES REGISTERED.

Defries & Goldman, Ltd. (138,300).—This company was registered on November 13th, with a capital of £2,000 in £1 shares, to take over the business of electrical engineers and factors carried on at Albion House, New Oxford Street, W.C., as Defries & Goldman, and to adopt an agreement with H. Defries and H. L. Goldman. The subscribers are:—N. Goldman, 80, Bishopsgate, E.C., director, 50 shares; W. Richards, Albion House, New Oxford Street, W.C., financial agent, 1 share. Private company. The number of directors is not to be less than two or more than ten; the first are H. Defries and H. L. Goldman (both permanent). Registered office, Albion House, New Oxford Street, W.

British Arc Welding Co. (Scotland), Ltd. (9,265).—This company was registered in Edinburgh on November 12th with a capital of £10,000 in £1 shares, to acquire a process for electrical welding to be given by The British Arc Welding Co., Ltd., and to carry on the business of ship repairers, shipwrights, contractors, etc. The subscribers (with one share each) are:—R. S. Kennedy, 41, Howitt Road, Belsize Park, London, N.W., engineer; J. Kennedy, 11, Fellows Road, South Hampstead, N.W. Private company. The number of directors is not to be less than two or more than six; the first are not named. Qualification, £300.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Hose & Rubber Co., Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital (if any), dated 3rd November, 1914, to secure all moneys due or to become due from the committee to London County and Westminster Bank, Ltd., 41, Lothbury, E.C., stamped to cover £1,500.

Chipping Norton Electric Supply Co., Ltd.—Notice is given that the debentures dated 20th October, securing £4,000, were not issued, and were cancelled by resolution of the directors dated 10th November, 1914, and the resolutions under which the same were authorised and created were rescinded.

Yorkshire Incandescent Electric Lamp Co., Ltd.—Issue on 24th November, 1914, of £3,000 debs., part of a series of which particulars have already been filed.

Llangefni Electric Light & Power Co., Ltd.—Capital, £3,000 in £1 shares (2,750 pref. and 250 ord.). Return dated April 15th (filed September 5th), 1914; 2,566 pref. and 250 ord. shares taken up; £2,566 paid; £250 considered as paid. Mortgages and charges: £1,900.

Fredk. Jones & Co., Ltd.—Capital, £15,000 in £1 shares Return dated July 6th, 1914; all shares taken up; £7 paid; £14,993 considered as paid. Mortgages and charges: Nil.

W. R. Sykes Interlocking Signal Co., Ltd.—Capital, £50,000 in 10s. shares (37,500 "A" and 12,500 "B"). Return dated September 30th, 1914; 42,297 "A" and 12,500 "B" shares taken up; 3s. 9d. per share called up on 42,297 "A" shares; £7,936 18s. 9d. paid (including £6 5s. paid in advance of calls); £16,824 5s. considered as paid (being 10s. per share on 12,500 "B" and 5s. per share on 42,297 "A"). Mortgages and charges: £12,500.

Thos. W. Ward, Ltd.—Capital, £450,000 in £1 shares. (150,000 pref.). Return dated October 12th, 1914; 150,000 pref. and 263,814 ord. shares taken up; £233,814 paid; £180,000 considered as paid. Mortgages and charges: £88,717 3s. 11d.

Brecknell, Munro & Rogers, Ltd.—Capital, £20,000 in 2,000 pref. shares of £5 each and 20,000 ord. shares of 10s. each. Return dated May 8th, 1914; 14,829 ord. and 1,058 pref. shares taken up; 10s. per share called up on 767 ord. and £5 per share on 1,058 pref.; £5,673 10s. paid; £7,031 considered as paid on 14,062 ord. shares. Mortgages and charges: £2,661 18s. 8d.

CITY NOTES.

Amazon Telegraph Co., Ltd.

Mr. George Keith (chairman and managing director) presided on Tuesday at the twentieth ordinary meeting, held at 42, Cannon Street, E.C.

In moving the adoption of the report, the Chairman said he regretted to say the income of their business fell very short of what it was last year. The scarcity of money, due to the severe fall in the price of rubber, had very seriously affected the trade of Manaos, which was the terminal station of their cables, and the principal source of their revenue. During the first three months commencing July last year the financial crisis led to a considerable increase in the traffic passing over their cables, but, onwards unfortunately for them, trade in general became very depressed and stagnant, and their traffic fell off in consequence during the remainder of the year. The traffic receipts showed a decrease for the whole year of £23,105, whilst interest on investments and the year's cash balance brought in £442 more. The total revenue, including subsidy and transfer fees, amounted to £83,751, or £22,915 less than last year. On the other hand, there had been a satisfactory saving in the expenditure. Station expenses showed a general decrease under the various items of £1,871. The expenses of maintenance of cables also showed a large decrease of £5,068, due principally to the fewer repairs being required by the cables, and to less cable having been used for that purpose during the year. The expenses of the *Viking*, including the cost of the extensive repairs she underwent, were also less. The *Viking* was laid up for that purpose nearly six months, and the *Ramos* did cable repairs during that time, which accounted for the increase in her expenses. Insurance and other miscellaneous expenses were also lower. Income-tax was £482 more, and the aggregate of the other charges came out £174 less. Altogether the working expenses amounted to £52,460, or £6,631 less than last year. After meeting these expenses and providing £22,966 for debenture interest and sinking fund, the directors recommended the payment of a dividend of 3 per cent., less income-tax, and the carrying forward of £5,840, as compared with £5,571 brought forward into the year's accounts. Their business was now suffering badly from the dislocation of trade due to the European war, and the outlook for the present year was anything but bright, but recent reports stated that trade in the Amazon was again beginning to show some signs of recovery. The cost of collecting rubber was being reduced to meet the lower price, and more attention was being given to the cultivation of fruit and other produce, and to the rearing of cattle. All this should no doubt in time further reduce the cost of rubber production, and add to the prosperous condition of the Amazon, and he thought they could still look forward to better business when the terrible war was over.

Mr. Ellice Clark seconded the motion.

Replying to a shareholder, the Chairman said he believed there were some signs of rubber being planted, but there was no mention of it in the latest Consular reports. He should have thought the planting of rubber in a place where it grew wild would be profitable.

The motion was carried.

On the resolution for the payment of the dividend, the Chairman said that the recommendation to pay it less income-tax was an innovation.

Mr. Ellice Clark said the idea of the board was to make the carry forward as large as possible.

Edison & Swan United Electric Light Co., Ltd.

Mr. C. J. Ford (Chairman) presided at the annual meeting at Winchester House, E.C., on Monday.

The Chairman, in proposing the adoption of the report, first dealt with the balance sheet, and said sundry creditors had risen from £36,000 to £48,000. This was in consequence of the increased business which the company had transacted during the year and was in respect of larger quantities of raw material and goods purchased. Loans, which previously stood at £20,000, now appeared at £7,000. On the credit side, their investments had been reduced from £58,346 to £10,643. This was wholly in respect of sales during the year of their interest in the Altrincham Electric Supply Co., Ltd. Last year he mentioned that the directors were proposing to take steps to dispose of a portion of their interest in that concern. As the shareholders were aware, they had sold the whole of the debentures, and, since he last addressed them, they had sold a portion of the 6 per cent. preference shares. As they were aware, the company held 33,346 ordinary shares in the Altrincham Co., and considering the substantial profits earned by it during the last few years, and the very favourable prospects for the future—the last dividend being at the rate of 8 per cent. per annum—they felt that these shares ought to be realisable at a figure considerably in excess of their face value; but the difficulty was to carry this into effect. They therefore got the Altrincham Co. to convert the whole of this ordinary share capital into 6 per cent. cumulative preference shares, and in consideration of the shareholders agreeing to limit their dividend to that rate they were offered the opportunity of subscribing at par for a 1s. deferred share in respect of each five ordinary shares held. These deferred shares were entitled to the remaining surplus profits after the payment of 6 per cent. upon the preferred capital, and their holding of deferred shares now amounted to 6,669, which shares they considered a valuable asset, although in the balance sheet they were only included at the amount paid for them, viz., £333. They were fortunate in disposing of the preference shares at par before the commencement of the war. In addition to the fully-paid preference, they held 5,000 similar shares partly paid, and they proposed to dispose of the whole of these as occasion offered. Of course, they had to pay the ordinary broker's commission upon the sale and there were other necessary expenses in connection therewith and the disposal of the debentures, all of which had been written off to profit and loss. Freehold and leasehold property stood at £65,846 against £69,346 last year, a reduction of £3,500. This difference was accounted for by the amount represented by the Benwell works, which had now been sold, and depreciation written off the remaining properties. Fixtures, fittings and office furniture had been increased from £4,456 to £10,247. This increase was represented by the expenditure upon the new show-rooms and offices in London and the depôts in the provinces. Plant and machinery had slightly increased by additions to the Ponders End works, all renewals having been charged against revenue. The stocks had been increased by, approximately, £32,000, which was accounted for by the general expansion of the company's trade, and sundry debtors were also higher by reason of the increase of the company's turnover. They had brought their goods prominently before the public by means of advertising, both by posters and in the newspapers, and during the past year the expenditure under this heading had been considerable, but he was pleased to be able to say that the result obtained had in every way warranted this expenditure. Probably during the current year the amount so to be expended would be somewhat reduced, as they found that at the present moment the works were very full of orders, and it might not be necessary, therefore, to incur such a heavy expense for the time being, but this, of course, was a matter which they were carefully watching. Up to the present he was pleased to say they had not felt any ill-effects from the war, excepting that they found, in common with all other traders, some difficulty in collecting accounts. The war had had one beneficial effect on them. It had stopped the importation of German lamps, etc., which were previously dumped here in large quantities, and he only hoped that after the cessation of hostilities the British public would continue to decline to purchase these German goods, and whole-heartedly support British manufacturers like themselves. Taking the accounts as a whole, he hoped the shareholders would agree that they were a great improvement on those of the previous year. Turning to the profit and loss account, they would notice that the amount brought to the credit from trading account a year ago was £17,603, whilst now it amounted to a considerably higher figure, viz., £51,244. Of course, he was aware that previously certain expenditure which was now shown in the profit and loss account was charged direct to trading account, but still, after allowing for this, there was a very great improvement, particularly in view of the fact that profit and loss had been debited with over £21,000 in connection with the new London show-rooms, provincial branches, the realisation of the Altrincham securities, and the removal of the clerical staff offices to the Ponders End works, advertising, etc., the greater part of which had not been incurred previously. On the other hand, the accounts before them did not include any benefit from the opening of the new London show-rooms, as owing to the long-continued building strike it was not possible to commence business until after the date of the period covered by the accounts; but he was pleased to say that the extensive display of modern high-class fittings, etc., was now having a very marked beneficial effect upon their sales. They had had a very anxious year, but in spite of the heavy extraordinary expenditure which he had referred to, a great deal of which at the date of the accounts had not been felt the full benefit of, they had converted a loss for the previous year of £4,700 into a profit for this year of, approximately, the same figure, which accounted for a difference in the results of the two years of close upon £10,000. With a view of increasing the company's output, the board had decided to extend the manufacturing facilities at the works to cope with the considerably increased business which, in common with other British manufacturers, they had participated in since the outbreak of the war, and which they had reason to believe would result in a permanent increase in the company's turnover. He thought it must have been very gratifying to them to learn that in a year of depression such as they had been passing through they were able to show such marked improvement in the result of the year's working, and he felt that the shareholders would now agree that the economies recently effected were beginning to produce the desired effect, and, further, that the shareholders would confirm that his statement that the business must be built up gradually was correct. He did not want to be too sanguine for the future, but, taking everything into consideration, the directors felt justified in looking forward to increased success.

Mr. Ellice Clark seconded the motion.

Mr. Wilson inquired if there was any large increase of workmen as compared with last year.

Mr. Parsons asked if any further explanation could be given as to what particular class of goods accounted for the large increase in the stock.

Mr. Rayment said they all knew that many companies had been advertising to the public that they were British and were in no way dependent on Germany or Austria. He recently met a man, largely interested in the electrical lamp trade, who told him he understood that the company had to pay very large sums in the way of royalties to German and Austrian firms in connection with their lamps. He was astonished to hear that, and thought it ought to be cleared up, because if they had to pay large royalties for their patents and other things they were not, strictly speaking, a British concern.

The Chairman said the staff had been increased to the extent of about 15 per cent. owing to the increase of business, and they were having rather a difficulty to get men. The stocks were increased all round. He was glad Mr. Rayment asked the question he did, as it gave him the opportunity of explaining the exact position. For a very considerable time they had made no payments to Germany. Last quarter, up to 30th September, which was certainly a heavy quarter, their payments were £75 to Germany under an old agreement, which, of course, was quite insignificant. The position to-day with regard to lamps was this: The old squirted lamp was owned by the Osram Lamp Co., and that was a German patent. Their company did not make these lamps. They had a few left in stock, which they were selling as quickly as they could. The lamp made to-day was the drawn-wire lamp, which was an American patent, and the whole of the lamps sold were made under that American patent. They would understand that there were certain raw materials which in the past, and, possibly, in the future, manufacturers in this country would have to draw from Germany, because they could not be got from anywhere else. Mr. Gimingham had pointed out to him that potash used in making lamps came from Westphalia, which was the only place in the world from which supplies could be got in convenient quantities.

Mr. Parsons asked if the lamp business was on a really satisfactory basis—he meant their business arrangements with regard to lamps.

The Chairman said he was not prepared to say that the arrangements which existed could not be improved, and they were doing their best to improve them. He could not say anything more at the moment because certain negotiations were pending which he hoped would be carried through satisfactorily.

The motion was carried, and the retiring directors and auditors were re-elected.

Mr. Parsons proposed a vote of thanks to the board and staff, and remarked that the improvement in the financial position of the company was a good augury for the future.

Mr. Rayment seconded the motion and spoke in flattering terms of the work of the Chairman.

The Chairman, in acknowledging the vote, referred to the very great assistance he had received from Mr. E. Gimingham and Mr. C. E. Hunter.

Western Telegraph Co., Ltd.

Sir J. Wolfe Barry, K.C.B. (Chairman), presided over the 81st ordinary meeting at Electra House, E.C., on November 11th.

In moving the adoption of the report (Elec. Rev., p. 634), the Chairman said the statement of accounts presented was in respect of the period of twelve months ended June 30th

last. Heretofore they had always been for periods of six months. Those which they had to consider were closed before war was declared, and therefore were not affected by this terrible calamity The receipts from messages compared with the previous twelve months showed an increase of £3,137, rents, interest on investments, etc., £11,734, together £14,871; but dividends on investments in other telegraph companies and interest on money on deposit were less by £1,745, leaving a net increase of receipts of £13,126. On March 1st, 1913, a service of "week-end" telegrams was instituted with Argentina, and in August of the same year this service and "deferred" messages were extended to Chile and Peru. The convenience of these lower-priced telegrams had been appreciated by the commercial and general public, and the growing use of these cheaper services had displaced a considerable amount of fully-paid ordinary traffic, resulting in a large volume of correspondence being transmitted, and this during a period when trade in Brazil and Argentina suffered a relapse which it was hoped was only of a temporary nature. These remarks would have prepared them for an admission of materially increased general expenses. Those in London were more by £232, which called for no comment. At the stations abroad, however, there was a net increase of £18,812. This increase was due to a necessary augmentation in the number of staff and improved scales of pay necessitated by the higher cost of living in South America, which accounted for nearly £14,000. The furnishing of new offices at Buenos Ayres and new staff quarters at Monte Video accounted for about £3,500. The other items, some more and some less, about balanced one another. Other expenses debited against the revenue account showed a net decrease of £3,819, principally in respect of land-lines and apparatus. The maintenance of the cables entailed an increased expenditure of just under £14,000, due to more cable having been used in repairs as cables got older, and to higher cost of their own and chartered cable-repairing steamers. Income tax was increased by nearly £1,300. The net result was that the balance of profit was £10,000 less than that for the previous year. Three interim dividends, amounting to £93,568 10s., had been paid, £160,000 transferred to the general reserve fund, £30,000 to the land and buildings depreciation fund, and £130,000 to the provision on account of investment fluctuation. The directors now recommended the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income tax, which together would amount to £51,982, leaving a balance of £33,157 to be carried forward. The amount transferred to the general reserve fund was smaller than in past years, and although the total standing to the credit of that fund was nearly £1,700,000, he might again remind the shareholders that their two main cables between Europe and Brazil were laid many years ago, the one in 1874 and the other in 1884. These were each over 3,500 miles in length, and would sooner or later require renewal, and at present prices would cost somewhere about a million and a half, which when the time came would have to be charged against the reserve fund. During these abnormal times it was impossible to fix a value for their investments, consequently the board had considered it necessary to make a further provision on account of investment fluctuations. With regard to the current period—viz., since July 1st last—they would remember that war between France and Germany commenced on Aug. 2nd and between Great Britain and Germany on Aug. 4th. The Government's censorship of telegrams was put in force on this side immediately, and Argentina and Brazil subsequently enforced similar restrictions. Circumstances necessitated the suspension of "deferred" and "week-end" telegrams until Oct. 1st, when the "deferred" service was resumed, as the company found itself in the position of again being able to carry deferred telegrams without any excessive delay. The shareholders would be glad to learn that the staff of the Associated Cable Companies was second to none in patriotism, and they had been able to grant permission to nearly 25 per cent. of the head office staff to join the colours, and it was only the efficient carrying on of the special work which had prevented their being able to sanction a very much larger number of applications at home and abroad; but he must add that in this matter they were acting in conjunction with the War Office. It gave him pleasure to remark that the staff were remitting handsome contributions monthly to the National and Belgium Relief Funds.

Sir J. Denison-Pender seconded the motion.

Mr. F. W. Fuller asked what the position of the company was since the declaration of war.

The Chairman said that during the first four months of the current financial year their revenue had been well maintained, but it did not show the increase which was generally anticipated would result from the abnormal conditions prevailing at the present time.

The report was then adopted.

Replying to a vote of thanks to the board and staff, the Chairman said the period had been one of very great stress since the outbreak of war, and Sir John Denison-Pender had been at work day and night, and on Sundays, in keeping the business of the company together. Sir John had very heavy burdens upon him, and he would like to take that public opportunity of saying how deeply that company and the associated companies were indebted to him for the care and judgment and unwearied application he had given to their affairs.

Hongkong Tramway Co., Ltd.

An extraordinary general meeting of the shareholders was held on Monday, at the offices, 19, St. Swithin's Lane, Cannon Street, E.C., Mr. Robert Miller presiding.

The Chairman, in proposing a resolution to alter certain of the Articles of Association, remarked that he had very little to add to the information contained in the circular convening the meeting. As many of them were aware, for some time past there had been a considerable demand for the company's shares in Hongkong and in the East, and the result was that ultimately the majority of the shares had come to be held there. Not unnaturally, he supposed, the shareholders felt they would like the company to be under local control. Matters continued to develop until August 1st, when an informal meeting of shareholders was held in Hongkong under the chairmanship of Sir Paul Chater. At that meeting a committee was appointed to take the necessary steps to change the control of the company by substituting a board of local gentlemen for the present directors. It was not possible for him (the Chairman) and his colleagues to forecast in any way the result of that change—time alone could prove that—all they could say was that they hoped for at least as much success in the future as in the past. In any case, the wishes of the majority of the shareholders, subject to the company's legal obligations to its debenture-holders, must be the determining factor as to its management, and the position having been laid before the trustees for the debenture-holders, who raised no objection, there was nothing more to be said. The accounts for the six months ending June 30th had been approved, and in the ordinary way the directors in London would probably have been able to recommend an interim dividend at the rate of 10 per cent. per annum. As, however, a new board would be elected at the meeting called for December 1st, the present board offered to leave the final decision as to the amount of the interim dividend to be settled by them.

Mr. Harwood seconded the resolution, which was adopted without discussion.

Electrical Companies in Germany.

The German newspapers are publishing extracts from the reports or financial statements of various manufacturing companies. A few of these are reproduced below:—

It is reported that the *C. Lorenz A. G. Telephon und Telegraphen Werke, of Berlin*, is largely provided with war orders, but private contracts have declined since the outbreak of hostilities. The amount of business with neutral countries is comparatively slight. It is added that the financial results for 1913-14 cannot yet be ascertained, and that the directors have not heard anything of the branch at Petrograd for some time past.

The A. E. G. Unternehmungen, A. G., of Frankfort-on-Main—a financial enterprise which was taken over by the A. E. G. from a manufacturing company two or three years ago—records gross profits of £36,000 for 1913-14, as compared with £39,000 in the previous year. Out of the net profits of £31,000, as against £32,000, it is intended to pay a dividend of 6 per cent. on the share capital of £500,000, being the same rate as in 1912-13.

The Bergmann Elektrizitats Werke, A. G., of Berlin, is stated to reckon with the possibility of a total passing of the dividend for 1914. The company has been seriously affected by the complete stoppage of oversea transport, as new orders from abroad only arrive to a limited extent, and deliveries under old contracts are greatly hampered at present. On the other hand, some compensation has been afforded by the receipt of important orders from the military authorities and the departments concerned are well provided with work.

The Deutsche Gasgluhlicht (Auer) Gesellschaft, of Berlin, which is interested in the Osram wire lamp, as well as in incandescent gas equipments, reports that the company's principal departments are being unfavourably influenced by the war, especially owing to the cessation of exports to a number of countries. For the year 1913-14 the accounts indicate net profits, after appropriating £24,000 for depreciation as against £25,000 in 1912-13, amounting to £263,000, as compared with £431,000. It is proposed to pay a dividend of 5 per cent. on the preference capital and 25 per cent. on the ordinary shares, being the same rates as in the preceding year, and to carry forward £101,000 as contrasted with £33,000 in 1912-13.

The Kabelwerk Rheydt A. G., of Rheydt, has declared a dividend of 12 per cent. for 1913-14. At the recent general meeting the Chairman stated that the financial circumstances of the company were favourable, a fact which was due to economic management and an economic dividend policy. How far the company had proceeded in that direction was shown by the ability on that occasion to pay the dividend without having any necessity to have recourse to outside sources. The Chairman exercised great reserve in regard to giving an expression of opinion as to the future of the undertaking. It was hoped that the German armies would be victorious, and in that event the company would also experience a further happy development. At present the works were occupied as far as they could be employed, and the company was earning plenty of money.

Chloride Electrical Storage Co., Ltd.—The *Financial News* states that the directors have determined, in existing circumstances, not to pay any interim dividend on the ordinary shares, but warrants in respect of the interim dividend at the rate of 6 per cent. on the preference shares will be posted on the 30th inst.

Castner-Kellner Alkali Co., Ltd.—The directors have declared a final dividend of 10 per cent for the six months ended September 30th, 1914, making a total of 15 per cent. for the year.

Rawlings Brothers, Ltd.—According to the *Financial Times*, the accounts show a net profit, including £945 brought forward, of £4,282. The directors have declared a dividend of 3 per cent. on the ordinary shares for the year ended March 31st, and £700 has been placed to reserve, leaving £1,196 to be carried forward.

West India and Panama Telegraph Co., Ltd.—The directors recommend the payment of dividends of 6s. per share on the first preference shares and 6s. per share on the second preference shares for the six months to June 30th, 1914, and 1s. 3d. per share on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

THIS week's settlement, which had been regarded in advance with such anxious misgivings by the whole of the Stock Exchange, has turned out to be less terrifying than most people expected. As usual when there is plenty of time to face difficulties, the preparations which were laid sufficed to blunt the keen edge of the prevailing fears. Heavy sacrifices are demanded, but these have been made—and cheerfully in most cases.

Little harm can be done by lifting the veil of official discretion with the statement, now, that a large number of Stock Exchange men prayed the Treasury to grant a kind of indefinite moratorium in respect of the accounts that were open at the end of July. To these the Treasury, with the Chancellor of the Exchequer and the Lord Chief Justice, opposed a refusal as blank as it was polite. They declined to give shelter to the Stock Exchange, when in the case of all other branches of the community, the raising of the moratorium on November 4th left people to make shift for themselves, aided with the assistance afforded by the banks. Therefore the Stock Exchange has been obliged to hold the settlement this week; as to its outcome, it is impossible to say much at present, except that indications point to a comparatively smooth arrangement of the account. Several weeks will probably be required before the Stock Exchange really knows how it stands, but the loose talk of hundreds of House failures occurring as the direct consequence of the settlement is not at all likely to be verified.

As we write, the investor is on the alert for the National War Loan prospectus. People have been holding back their savings, for some time past, with a view to lending money to the Government through the medium of the War Loan. We know of cases in which investors—mostly small, it is true—have deliberately refused to put money into tempting securities that pay good yields, preferring to subscribe to a War Loan, even though it may mean a difference of ½ per cent. per annum in their income, with the possibility of a loss in capital value if the news does not happen to be good. Patriotism cannot complain that it has no free scope these days.

As to the news from the front, Throgmorton Street is well persuaded that the war is going on fully as satisfactorily as could be wished by anyone who was not an impatient enthusiast for impossible events. And it is generally expected that when the November 18th settlement is fairly out of the way, and the war loan publicly launched, there will be a resumption of activity in Stock Exchange markets that shall have an immediately strengthening effect upon quotations.

In view of the fact that prices are beginning to re-establish themselves on reliable bases, it has been decided to begin in these columns the publication week by week of leading securities connected with the electrical markets. Middle quotations are furnished in each case, this being because in some instances it is difficult to buy, or difficult to sell, as the case may be. Just at present, for example, the demand for electricity supply shares is so feeble that double quotations might convey a false impression. So we content ourselves—and, we hope, our readers—with a selection of middle prices of representative stocks and shares in companies connected with the electrical industry; and if there is a desire for others, previously given in our weekly lists, and at present omitted from the accompanying tables, careful effort shall be made to ensure their correct quotation upon our receiving a request for such.

Home Electricity Supply Companies.

Brompton Ordinary	8⅜	Kensington Ordinary	7⅛
do. 7 per cent. Pf.	8⅝	London Electric	1¼
Charing Cross Ordinary	4⅜	do. do. 6 per cent. Pf.	5
do. do. do. 4½ Pf.	4¼	do. do. 4 Deb.	89½
do. do. City Pf.	4⅛	Metropolitan	3
do. 4½ Deb.	86½	do. 4½ per cent. Pf.	4½
Chelsea	4⅜	do. 1st Deb.	91½
do. 4½ Deb.	91½	do. 3½ Deb.	81½
City of London	15	St. James' and Pall Mall	9
do. do. 6 per cent. Pf.	13	do. do. 7 per cent. Pf.	7
do. do. 5 Deb.	115	do. do. 3½ Deb.	83
do. do. 4½ Deb.	98	South London	3
County of London	11⅛	South Metropolitan Pf.	1⅛
do. do. 6 per cent. Pf.	11⅛	Westminster Ordinary	3⅛
do. do. 1st Deb.	99	do. 4½ Pf.	4⅜
do. do. 2nd Deb.	97		

Manufacturing Companies.

Brit. West. Pf.	1½	Electric Construction	11s.
do. 4 Deb.	72	do. do. Pf.	1
do. 6 p. lien	98	Gen. Elec. Pf.	10
Callenders	11½	Henleys	1½
do. 5 Pf.	4⅜	,, 4½ Pf.	4⅜
do. 4½ Deb.	97½	,, 4½ Deb.	97½
Edison & Swan, £2 pd.	6s.	Telegraph Con.	38½
do. do. £7 pd.	1⅜	Castner-Kellner	2⅛
do. do. 4 Deb.	69		
do. do. 2nd Deb.	63½		

Telegraphs and Telephones.

Anglo-Am. Tel. Pf.	101½	Gt. Northern Tel.	29½
do Def.	21	Indo-European	58
Chili Telephone	7	New York Tel. 4½	96½
Constantinople Tel.	4½	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8⅝	do. Pf.	1⅞
do Pf.	15½	Tel. Egypt Deb.	97
Eastern Extension	11⅜	United R. Plate Tel.	6
do. 4 Deb.	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1⅞
do. 3½ Pf.	74½	Western Te'egraph	12½
do. 4 Deb.	95	,, 4 Deb.	95½
Globe Tel. and T. Ord.	1⅞		
do. Pf.	12⅜		

Foreign Trams, &c.

Anglo-Arg. Trams 1st Pf.	4½	Bombay Electric Pf.	11
do. 2nd Pf.	4⅛	do. 4½ Deb.	96
do. 4 Deb.	86½	Mexico Trams.	52½
do. 4½ Deb.	95½	do. 5 per cent. Bds.	72½
do. 5 Deb.	88½	do. 6 per cent. Bds.	72½
Brazil Tractions	50	Adelaide Sup. 6 per cent. Pf.	5⅞
		do. 5 Deb.	103½

The Castner-Kellner Alkali Company declares a dividend of 10 per cent, making 15 per cent. for the twelvemonth. This latter compares with 22½ per cent. a year ago, when, however, a bonus of one new share for two old was distributed through capitalisation of part of the reserve. Making allowance for this, the dividend for 1913-14 is the same as that for the previous year. Castners are now 53s. bid, and shares in most chemical companies are a good deal in demand, on the assumption that their manufactures will take the place of a lot of stuff hitherto imported from Germany. Incidentally, it may be mentioned here that Rubber shares are again on the mend, evidence accumulating to the effect that there is a rubber famine threatening in Germany, while on this side the approach of winter has already caused the War Office to place big contracts of all kinds of waterproof material, not only for the troops, but for their horses also. In addition to which, of course, there are the hospitals, which will be taking, unfortunately, large amounts of rubber in connection with comforts for the wounded.

Brazilian Traction shares have improved to 50 bid, some four or five dollars higher than the price stood comparatively lately. Matters in the Brazilian Republic seem to be getting better, but in Argentina the continued pressure of the moratorium appears to have the effect of checking business all round, so that English companies operating in that Republic are doing none too well just at present. The Mexican imbroglio exhibits no new development. Mexico Trams are 52½, while both classes of bonds are quoted 70-75.

Home Rails are distinctly firmer in tone and price. The sudden activity noticed on the Northern suburban lines early in the week, gave rise to the report that a quarter of a million fresh troops were being despatched to the Continent. Speculation busies itself with the discussion as to what percentage of the men who are seeing active service, and who will return from the war, is likely to settle down contentedly to desk, office, warehouse, Stock Exchange or similar pursuit hereafter. Metropolitans rose to 30½, after dipping to 30. Districts are steadier at 18¼. The new London and South-Western 5 per cent. Preference stock, which was issued at 99¾—the money being required for electrification of the line—holds its price at 103½. Various new issues are being talked about, but it is worth noticing that the Government has warned off some of the big Colonial borrowers by the simple expedient of lending them the money itself, and including these loans in the national war stock.

The Western Telegraph Company's report is a good illustration of the prudent finance shown by the best-class cable undertakings. The revenue for the year ended June 30th last came to £903,000, the working expenses to £390,000. After providing for Debenture interest and income-tax there remained a divisible balance of £499,000, out of which the dividends and bonus for the year took only £155,000. The company has invested reserve funds of £1,896 276, while other items bring the reserves to over two million pounds sterling. In the current balance-sheet £300,000 is deducted as provision on account of investment fluctuations. Figures like these give some idea of the remarkable strength of the best telegraph companies, and show how slight is the chance of the dividend being reduced in any but an insignificant way, if at all. Western Telegraph shares can be bought at 12¾, or a little less, so that, at the present price, the return on the money comes to £5 9s. 10d. per cent.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1914.

Although not up to the level of the period before the war, the October returns of electrical exports and imports show a great improvement.

The exports, which for the first half of the year averaged half a million pounds a month, fell to £239,000 in August, increased to £288,000 in September, and reached £401,107 in October.

The import figures comparable with the above were:—Six months' average £275,000, August £87,000, September £111,000, and October £168,431.

The re-exports for October amounted to £15,547, as compared with some £26,000, the average of the first six months of the year.

Of the individual export sections, machinery exports improved to the extent of some £86,000, and increases were shown in the telegraphic, lamp and miscellaneous sections; cable exports were nearly stationary, while some falling-off is shown in the telephonic exports. Russia was a good customer during the month, some £43,000 of machinery going to that destination; India, Argentina, Australia, Japan, &c., were also prominent customers of this country.

The increase in the imports is mainly traceable to business with the United States, which jumped up some £53,000 in the month.

Machinery imports increased by over £40,000; a considerable advance occurred in lamp imports, principally from Holland, but also from the U.S.; but telegraphic and telephonic imports decreased. Sweden and the U.S. were active importers of telegraphic and telephonic material, while Switzerland figured as a machinery importer. No doubt the dislocation of manufacturing in this country, due to military engineering requirements, accounts for the entry of a proportion of the imports.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	5,745	501	248	2,476	97	1,964	48,415	1,175	260	352	2,216	6,216	69,665
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	252	1,044	312	...	305	268	694	711	232	...	...	360	4,178
Belgium	265	...	...	...	...	7	11	...	143	...	...	65	491
France	139	...	103	12	...	...	150	...	...	81	...	1,222	1,707
Portugal	5	...	157	...	...	50	351	66	124	27	154	216	1,150
Spain, Canary Isles and Spanish N. Africa...	879	...	181	...	...	66	591	667	172	...	12	123	2,691
Switzerland, Italy and Austria-Hungary ...	119	...	736	...	...	872	5,085	240	...	67	...	...	7,119
Greece, Roumania, Turkey and Bulgaria ...	...	...	...	...	...	...	53	55	...	...	...	...	108
Channel Isles, Gibraltar, Malta and Cyprus...	81	339	39	18	...	...	152	...	22	...	7	84	742
U.S.A., Philippines and Cuba	238	...	819	379	...	121	655	29	10	4	...	312	2,567
Canada and Newfoundland	193	3,573	957	799	...	405	5,961	...	1,081	10	99	198	13,276
British West Indies and British Guiana ...	30	86	25	214	...	...	197	...	45	...	112	205	864
Mexico and Central America	34	108	67	20	...	...	265	...	...	...	...	36	530
Peru and Uruguay	16	17	...	19	...	...	179	...	15	...	592	993	1,831
Chile	61	462	74	23	...	18	927	...	...	...	26	649	2,240
Brazil	263	86	205	69	30	503	1,145	516	...	...	1,545	41	4,403
Argentina	10,939	1,598	395	180	...	62	7,753	809	617	153	1,219	2,264	25,989
Colombia, Venezuela, Ecuador and Bolivia...	114	105	55	301	...	75	64	...	...	...	9	100	823
Egypt, Tunis and Morocco	309	327	379	...	16	68	1,092	...	30	43	33	474	2,771
British West Africa	108	81	...	37	40	...	775	32	143	...	350	333	1,899
Rhodesia, O.R.C. and Transvaal	827	53	1,070	2,222	...	466	313	5,450	22	...	43	...	10,466
Cape of Good Hope	959	1,027	591	626	10	430	5,966	88	723	27	5	392	10,844
Natal	743	4,948	386	986	58	239	3,536	521	81	...	83	617	12,198
Zanzibar, Brit. E. Africa, Mauritius & Aden	8	275	4	138	...	...	...	11	272	...	...	99	807
Azores, Madeira and Portuguese Africa ...	93	552	84	...	...	...	12,633	12	...	70	...	28	13,422
French African Colonies and Madagascar...	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	960	124	568	46	32	65	3,505	1,762	12	...	12	3,039	10,125
Japan and Korea	328	...	5	23	...	1,159	16,988	63	1,515	3	...	335	20,419
India	2,803	13,621	3,737	1,415	16	1,811	13,991	9,005	2,606	18	2,892	4,742	56,157
Ceylon	392	516	82	97	...	3	826	...	71	...	13	1,745	3,745
Straits Settlements, Fed. Malay States and Sarawak	1,487	577	599	29	39	51	3,067	80	521	...	872	6,244	13,516
Hong Kong	662	1,120	588	...	...	283	629	9	91	...	14	145	3,541
West Australia	414	425	293	140	...	421	501	...	443	15	121	88	2,861
South Australia	394	25	666	40	...	18	657	470	48	...	188	444	2,950
Victoria	1,321	12,871	1,241	2,734	...	1,353	3,514	186	1,167	4	4,615	3,396	32,402
New South Wales	1,054	10,866	1,209	1,566	209	534	9,051	3,452	952	20	714	7,329	36,456
Queensland	191	816	53	169	...	...	2,054	35	734	84	806	...	4,892
Tasmania	7	24	168	41	...	...	156	...	...	...	1,600	5	2,001
New Zealand and Fiji Islands	582	3,246	970	398	...	1,798	8,920	1,266	762	12	945	362	19,261
Total, £	32,965	58,863	17,016	15,217	852	12,610	160,822	26,710	12,914	940	19,297	42,901	401,107

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	25	56	66	...	423	...	3,285	...	68	960	6,192	11,075
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	195	137	...	6,336	5,375	...	172	112	15	...	...	12,342
Belgium	...	22	1,356	...	...	...	...	...	20	...	...	4,398
France	8	...	487	113	19	...	64	...	4,554	2,873	202	8,320
Switzerland	250	112	75	...	104	749	7,568	...	...	684	...	9,542
Italy	72	2,566	20	...	...	...	1,806	300	...	...	272	5,036
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	7,219	1,048	610	118	3,567	23	27,838	67,025	1,034	2,313	5,687	116,482
Total, £	7,769	3,941	5,614	6,567	9,488	772	40,733	67,437	5,691	6,830	12,353	167,195

Additional imports: Spain: carbons, £684. Victoria: electrical machinery, £58. Canada: electrical goods, £85; meters, £355; machinery, £54.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	2,121	1,016	...	804	105	...	7,157	...	140	231	3,973	15,547

TOTAL EXPORTS: £401,107 TOTAL RE-EXPORTS: £15,547 TOTAL IMPORTS: £168,431

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

NOTES ON MODERN CONTINUOUS-CURRENT MOTORS.

By T. H. DENNIS, A.M.I.E.E., Singapore.

The more one studies the so-called improvements in manufacturers' latest patterns of machines, the more it becomes impressed upon one's mind that the sole factor governing modern design appears to be cost of manufacture.

This is undoubtedly as it should be—to a certain extent—but when these methods are carried to an extreme and *all* other considerations are lost to view in the continued striving to cut down material, some parts are made of such small dimensions, or of such inconvenient patterns, as to be a nuisance.

The designer appears to lose sight of the fact that the machines are made for *use*, and in his anxiety to cut down the material used to the absolute minimum, he apparently keeps common-sense and practical knowledge right at the back of his head.

In this article are noted various details that have actually been met with by the writer, and some suggestions for improvements prompted by practical application.

Slow-Gearing.—As instancing the lack of practical common-sense displayed by designers, has anyone ever seen a makers' standard pattern of slow-geared motor illustrated with the pulley or half-coupling fitted at the *same* end of the slow-speed shaft as the spur-wheel? The writer has not been able to find such an illustration, and yet is not this the correct position for the pulley?

A motor is always erected, if possible, with the belt running close to a wall or partition or guard; thus with the standard arrangement of spur-wheel and pulley the commutator end of the motor is brought towards the wall, easy access to the commutator being then prevented both by the wall and by the proximity of the belt, or of the driven machine when a coupling is used. As the commutator of a machine generally requires constant attention (low-tension motors are the machines actually referred to in this article), and brushes require renewing very often without its being convenient or possible to stop the motor, this point concerning the position of the pulley or half-coupling is quite important.

With the pulley fitted at the *same* end of the slow-speed shaft as the spur-wheel, the belt and gearing are kept remote from the commutator, and the latter is, in all probability, not close up to a wall, and it is, of course, right away from the driven machine.

The writer has in mind a dozen small slow-geared motors driving similar parts in one large machine; these motors are erected in line several feet apart, and their half-couplings are close up to the long side of the large box-like machine referred to. Fortunately, when these motors were ordered it was emphasised that the half-couplings should be at the *same* end of the slow-speed shafts as the spur wheels, and the result is that all the commutators are easily accessible and easily inspected, as they are remote from the large (driven) machine, and also they are away from the grease and dirt of this machine. Had these motors been of the standard pattern with the half-couplings at the commutator ends, it would have been most difficult to inspect and clean the commutators and change the brushes and so on.

In every case that one considers, the best arrangement seems to be that with the pulley at the same end of the slow-speed shaft as the spur-wheel. Why, then, do manufacturers not make this the standard design, instead of continuing to illustrate their motors with the pulleys close up to the commutators?

High Speed.—A favourite method of lowering the price of a motor for a given horse-power is to make the speed unreasonably high. This is often the case when a slow-geared motor is ordered and the speed of the slow-shaft only is specified. It is always advisable when ordering slow-geared motors to state a limit for the armature speed as well as to give the slow-shaft speed required.

The tendency is to increase the limit of maximum speed for plain motors, but it is the writer's experience that it is advisable to specify as low a speed as reasonably possible, owing to the commutator, brush wearing and sparking troubles at high speeds. Many manufacturers appear to make no difference in their brushes for high speeds, and even in those cases where different quality brushes are fitted there is generally trouble with excessive wearing of the commutator at very high speeds; thus it pays to give a little more for your motor in the first instance, and have it built to run at a reasonably low speed.

In many cases, too, the makers' standard pulleys (at the standard high speeds) appear to be too small to give satisfactory running in practice, unless the driven machines be working under almost ideal conditions with ideal belt drives.

The foregoing forms rather a wide generalisation perhaps, but the intention is to show that, as the standard high speeds and consequent small pulley diameters seem to be solely the outcome of the aforementioned striving by designers to cut down their manufacturing costs, and so to undersell their competitors in certain (horse-power) sizes, it is better in the long run to use a motor having a reasonable speed and pulley diameter than to adopt a high-speed machine with a small pulley, even if it *is* a manufacturers' standard and recommended as being quite suitable.

Brush-Gear.—Brush-gear lends itself to many and various designs, and although the box-type now appears to be almost universally used, there are few patterns that are quite satisfactory.

In the majority of holders it is a difficult matter to renew a spring, and in most patterns the springs are so made and fitted that it is almost impossible to clean them, and so keep them from becoming clogged up and useless. Also, it is a very difficult matter to persuade manufacturers to give you phosphor-bronze springs instead of steel. Steel springs, even if they are plated, rust very quickly in moist tropical climates, and, even at home, one would think phosphor-bronze springs would be much preferable.

Some makers are now standardising *steel* brush spindles and *steel* brush boxes as well as steel springs, &c., and although this sort of thing might be suitable for use at home (even this seems doubtful, as motors frequently have to work in damp positions at home as elsewhere) it is out of the question for moist tropical atmospheres.

An annoying point in this respect is that the purchaser is frequently told that the steel spindles, &c., are not fitted for the sake of *cheapness*, but this seems to be the only obvious reason. Could some brush spindles not be cheapened (without this being detrimental to the buyer) by making them of hollow instead of solid brass?

A curious and aggravating fault in the matter of brush-holder spindles is that, although the designer is for ever cutting down the material used, he very frequently makes the heavy solid brush-spindles longer than necessary. In the majority of patterns the brush-holders are placed in position by passing them over the ends of the spindles, and if there is not sufficient space between the ends of the spindles and the commutator lugs to allow of the brush-holders being taken off without interfering with the spindles, it takes a long time to take off the holders for cleaning purposes, and entails sometimes a great amount of what should be unnecessary work.

In some cases it is possible by loosening the nuts holding the spindles in position to push the spindles sufficiently far through the brush-rocker arms, but in other instances it is not possible to get the holder off without taking off the pulley and end-shield, to allow the armature to be withdrawn a short distance.

Only a few days ago the writer had $\frac{1}{4}$ in. cut off the ends of some $1\frac{1}{4}$-in. diameter brush spindles. In this machine the screws for clamping the brush-holders to the spindles are cut down to the smallest possible dimensions, and are frequently getting broken, yet these machines are presumably being manufactured daily, so to speak, with every $1\frac{1}{4}$-in. diameter brush spindle at least $\frac{1}{4}$ in. too long; this is a case in which a little practical knowledge, combined with a little common-sense, would save the maker a very considerable amount of brass and machining, and would at the same time benefit the user of the motor.

Another machine has eight 2-in. diameter spindles, each carrying 13 brush-holders, and in no case can any of these brush-holders be taken off without shifting the spindles.

In still another machine the spindles were in such close

proximity to the commutator lugs that slight end wear of the bearing bush would have allowed the lugs to touch. A quarter of an inch was cut off these also.

In the case of two similar motors the holders could be just got off one and could be just not taken off the spindles of the other, and in both the spindles could well have been ¼ in. shorter.

The explanation of the foregoing seems to be that the designer wishes to ensure the whole width of the commutator being available for the brushes; but in the cases mentioned the brush boxes are wider than the holders which carry the boxes, and which are clamped on to the spindles, so that shortening the spindles did not prevent the inner brushes being fixed as close as necessary to the commutator lugs.

Most types of brush-holders, as already noted, are made to be passed over the ends of the spindles, and clamped on to them by means of one small tightening screw; this pattern may be cheap to manufacture, but they are generally a positive nuisance, as anyone who has chipped pieces of skin off his knuckles trying to get the holders on and off will appreciate. They are either bored out to such a large diameter that the tightening screws will not cause them to grip the spindles reliably, resulting in broken screws, or the holes are so small that the spindle is loosened in the brush-rocker arm by the holder seizing on to it.

Then, again, when the holders are bored out carefully and correctly, the nature of the brass is not always such that it allows of the holder springing open sufficiently when the tightening screw is loosened, to permit the holder to be easily slipped along the spindle.

A much better type of holder appears to be coming into more general use; in this pattern the part which clamps on to the spindle is hinged, and those with which the writer is familiar are very well made and have substantial clamping screws. With these holders any one can be taken off easily and quickly without disturbing any of the others, and although they would perhaps appear at first sight to be more expensive than the other type, owing to the hinge, it is doubtful if they do cost the manufacturer any more—especially if they are made in cast-iron (!) as appears to be some makers' standard practice.

Taking into consideration the fitters' time, as well as the machining, it is quite possible the hinged pattern are cheaper than the others, as there is no time wasted in dealing with holders that seize on to the spindles.

Brush-holders should be so made (at any rate in the case of low-voltage machines) that a brush can be changed without stopping the motor, and without the necessity of one hand having to be used to hold the spring out of the way of the brush and from touching the commutator; the particular hinged holder referred to possesses these advantages also.

A common fault with box-type holders and brushes is that the tails attached to the brushes are often too stiff and short, thus preventing the brush from sliding freely in its holder, and, in many cases, the tail is so fixed that the brush cannot be easily taken out for cleaning. Some brushes fit too tightly in their holders to allow of free movement, and in most cases the brushes have to be taken out periodically, owing to dirt collecting and causing the brushes to stick; thus they should be made easily removable.

Oil-rings.—With some recently-manufactured machines, wherein, as already noted, everything appears to be sacrificed to low cost of production, the oil-rings are so placed that they can only just be seen; that is, provided there is nothing in the way to prevent one's head being brought down to the level of the oil well, and one carries matches, and has good eyesight; the rings at the pulley end cannot be seen at all with the pulley in position—these machines have one ring to each bearing. In the case of some larger similar motors, with two rings to each bearing, the outer ones can just be seen at the commutator ends (not at the other ends with belt-pulleys running), but the inner rings cannot be seen at all.

The reason for this is apparently that the designer has not been able to make the oil-box cover come approximately vertically over the oil-ring and at the same time get the oil-ring placed at the centre of the bush; one appreciates the difficulty, but the fact remains that in most older machines the oil-rings can be easily seen through the oil-box covers, two covers being generally fitted if there are two rings.

Oil-rings very frequently get displaced during transit, and it is generally a more or less difficult matter to get them back into their correct positions, especially when they cannot be seen, when in place, from the oil-box covers.

It would not appear to be very difficult to fit the oil-rings so that they could not get out of position, or to hold them temporarily in position during transit; when a machine or several machines arrive with both rings right out of the bearing and resting close up to the commutator end-plate, it takes a long time and requires a lot of practice and patience to get them back into position by means of bent wires—nearly as bad as picking a lock of which you have lost the key.

WIRELESS SOCIETY OF LONDON.

A well-attended meeting of this Society was held on Friday, November 13th, in the theatre of the Institution of Electrical Engineers, the speaker of the evening being Prof. J. A. Fleming, who delivered an address on "The Function of the Earth in Radio-telegraphy." The chair was occupied by the President (Mr. A. A. Campbell Swinton), who explained that the experiments that night were shown by special permission of the Post Office. Prof. Fleming suggested that, during the period of idleness enforced on wireless workers, so far as practical radio-telegraphy was concerned, there were many mathematical and scientific problems awaiting solution which might profitably be attacked. It was an undoubted fact that the nature of the earth's surface exerted a most important effect on wireless transmission over it. In certain districts there was quite abnormal wave attenuation as, for instance, north and north-east of Newport (Rhode Island) in the district where Dr. Austin's experiments were carried out between Brant Rock and the cruiser *Birmingham*. The speaker showed how, by comparatively simple mathematics, the depth of penetration of an electric wave into a conducting material could be calculated. If ρ represented specific resistance, μ permeability, and n frequency, then at a depth of $1/2\pi \cdot \sqrt{\rho/\mu n}$, the current would have fallen to 0·368 of its surface value, and at four times this depth it would have fallen to $(0{\cdot}368)^4$ of its surface value, *i.e.*, to a negligibly small value.

Assuming standard physical properties, the depth of the "current skin" in copper was about ¼ mm., but in iron it was only $\frac{1}{50}$ mm., owing to the high permeability of this metal. By means of striking cymometer experiments, Prof. Fleming demonstrated the marked difference between depth of current penetration in these two cases, and showed that while insulating coverings did not affect the damping produced by the magnetic properties of iron, galvanising provided a skin of zinc thick enough to carry the high-frequency current without permitting the latter to reach the iron core. Galvanised iron wire was, therefore, permissible for aerials and for earth connections so long as the galvanising remained continuous and uncorroded.

The materials of the earth's crust were conducting dielectrics, and the problem of current penetration was complicated by the fact that conducted current and dielectric current had both to be taken into account. The conductivity of all dielectric materials, even if imperfect dielectrics, was much greater for alternating than for direct currents, and was vastly greater still when carrying currents of radio-telegraphic frequency. Thus, the conductivity of slate was 50,000 bimhos at 920 cycles, 204,000 bimhos at 5,000 cycles, and no less than 2,500,000 bimhos at 2,500,000 cycles per second. At yet higher frequencies the conductivity again decreased. There was a fertile field for research in measuring the conductivity and dielectric constants of sea water and earth crust materials at radio-telegraphic frequencies, and particularly valuable results might be expected from really large scale experiments (say, with huge electrodes ½ mile or so apart, which would give reliable averages for various kinds of soil under various conditions).

Prof. Fleming showed mathematically that refraction of electrostatic fields between air and earth or water produced a considerable horizontal component near the surface, thus producing a periodic displacement or wave in the earth's crust. This phenomenon the speaker demonstrated experimentally, and to it he attributed the possibility of reception of time signals on such unorthodox aerials as bedsteads, bicycles and dustbins. Atmospheric refraction had, no doubt, a marked influence on long-distance transmission, and if our atmosphere were exclusively of crypton (or were otherwise brought to the same vertical density gradient as given by crypton), light or Hertzian waves would travel right round the earth by refraction. Though much yet remained to be learned, it was definitely established that good conductors prevented deep current penetration; that penetration and attenuation occurred apart from mere weakening by diffusion; that attenuation was greater for short than for long waves, and reached a maximum at certain values of permeability, resistance and dielectric constant; and that the curvature of the earth weakened the true space wave, degrading it as function of the angular distance of transmission. At 3,000 to 6,000 miles, most of the received effect was probably due to bending by ionic refraction. Long-distance reception was complicated by many factors, and our earth was probably unique

in being the only planet on which long-distance radio-telegraphy was possible.

In opening the discussion, Mr. W. Duddell agreed that earth currents probably contributed considerably to long-distance transmission by long waves. He thought, however, that these currents were an essential part of the radiations, and to consider their action was only another way of regarding the problem as a whole.

Prof. G. W. O. Howe supported this view, saying that if the space wave were not associated with an earth wave, it formed a closed loop and was lost to us for purposes of signalling. As regarded the wide variations in strength of the Eiffel Tower time signals, as received by the author in London, it would be necessary to erect a control station near Paris to determine the emitted energy on different days, before drawing conclusions from the London curves.

In his reply, Prof. Fleming said that space and earth waves were certainly part of one entity, but the earth currents were a very active component in many cases.

The President, in moving a vote of thanks, announced that the authorities had adopted very effective means to deal with illicit wireless stations, and though the proffered assistance of the Society could not be utilised in this connection, steps were being taken to schedule members of all wireless societies in the kingdom, and their assistance would then be accepted in certain matters by the local police authorities.

ECONOMICS OF ELECTRIC RAILWAY DISTRIBUTION.

By H. F. PARSHALL, D.Sc., M.Inst. C.E.

(*Abstract of paper read before the* Institution of Civil Engineers, *November 17th*, 1914.)

Practically all modern traction systems of the larger class are referable to the same class of power house and transmission system, and these are not affected to any important extent by the sub-station arrangement, which is determined with reference to variations in the operating result occasioned by the spacing and the capacity of the individual sub-stations.

In the book by Mr. Hobart and the author on "Electric Railway Engineering," most of the problems entering into the design of electric railway installations have been dealt with. The question of the economic arrangement of sub-stations and the distribution conductors was not dealt with at length, because at the time the book was written sufficient operating data were not available to furnish a basis for different calculations. Such a wide difference of opinion existed between different engineers as to the cost of operating and maintaining a system of sub-stations that it did not appear advisable to treat the subject except on general lines. Since the publication of that book a great deal of experience has been gained, as a result of which engineers have come into more general agreement as regards sub-station practice. The present paper is written with a view to assist towards the standardisation of electric railway sub-station practice. Many years ago Lord Kelvin formulated a law as to the economic use of conductors in transmission systems. The number of independent variables when a complete system with sub-stations has to be dealt with is so great that the mathematical expression, from which might be deduced the minimum cost, would in practice be open to some suspicion. In this paper a complete balance-sheet embodying every item has been worked out for each case, and the tabulated result is included as a part of the paper; hence, for different conditions it would be possible for an engineer to make the necessary corrections, so that, without any great amount of labour, the methods and results of the paper may be applied to practically any class of electric railway installation. The paper has not been extended to include the electric traction installation as a whole, since the process of standardisation in respect of motor equipments is still proceeding, and conclusions that might be drawn under present conditions would in another short time be incorrect. So far as the distribution is concerned, the conclusions are likely to be lasting, since the operating conditions on which the general results are founded are likely to obtain for a considerable time to come.

With the given energy-consumption per unit of length of line that follows from a given train movement, the capacity of the sub-stations increases directly with the distance between them. The energy loss in distribution conductors of a given section varies with the cube of the distance between sub stations. The cost of attendance is within wide limits independent of the size of the sub-station. The cost of the plant per kilowatt falls off with the size of the units, but the maintenance and renewals per kilowatt are more or less constant. The paper embodies a series of curves showing graphically the arrangements of sub-stations that will operate different train services on different electrical systems and at various voltages with a minimum total operating cost. With rotary-converter sub-stations and a working voltage of 600 volts, and for certain assumed average conditions of train-weight, speed and energy-consumption, the most economical sub-station spacings are 8¼, 5½ and 3¼ miles for train-services of 6, 12 and 24 trains per hour, respectively. For a working voltage of 1,200 volts the sub-station spacings are 11, 7½ and 5 miles respectively, while when 2,400 volts is adopted the most economical sub-station spacings are 16, 12 and 8¼ miles for the three train-services respectively. Curves are also given illustrating the advantage gained by working at higher voltages, and these confirm the author's view that with the present arrangement of rotary-converter sub-stations there is little advantage in a higher voltage than 2 400 volts for the track conductor. The economy of higher voltages is shown to be approximately the same whatever the train-service. As between 600 and 1,200 volts there is a saving of 14 per cent. in the total annual costs of the distribution system; as between 1,200 and 2,400 volts there is a further saving of 7 per cent., or 21 per cent. as between 600 and 2,400 volts. If the working voltage is further increased to 3,600 volts, there is a decrease in total annual expenditure on sub-station and overhead conductor equipment of only 3 per cent., which will be less than the additional costs of the rolling stock.

For single-phase distribution at 5,000 volts the most economical sub-station spacings are 31, 24 and 16 miles for train-services of two, three and six trains per hour respectively. At 10,000 volts single-phase, the most economical sub-station spacings are 45, 34 and 26 miles for the same three train services respectively. With three-phase distribution at 5,000 volts the most economical distances between sub-stations are 38, 31 and 18 miles for the same respective train-services. In most of these last cases, however, the economical distance between sub-stations thus determined is greater than would be permissible in practice from considerations of both traffic-operation and voltage-drop. Further, in the case of single-phase operation, the lower pressure of 5,000 volts is found to be the most economical for certain services and the higher pressures of 10,000, 12,000 and 15,000 volts in vogue on the Continent are explained by consideration of voltage-drop.

An appendix to the paper summarises the sub-station operating costs of the Central London Railway, which have been used to a large extent as a basis for the calculations embodied in the paper.

CABLES.

By C. J. BEAVER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *November 12th*, 1914.)

Pressures up to 20 kilovolts have called for no special effort on the part of the cable maker; he has had to pay more attention to potential gradients in 20-kilovolt to 30-kilovolt cables than in those already standardized by the Engineering Standards Committee for working pressures up to 11 kilovolts. But apparently nobody had the courage or opportunity to take the step of reversing the practice of increasing the thickness of the dielectric as the size of the conductors increased.

The importance of this, however, disappears at higher voltages. For instance, at 20 kilovolts working pressure the commercial considerations which entail the selection of such a voltage also to some extent automatically determine the most commercially economical (from the transmission and distribution point of view) size of cable. This will not vary widely from 0.1 sq. in. to 0.15 sq. in.

At still higher working pressures, 50 to 100 kilovolts, another set of conditions preponderates, the maximum stress conditions tending to fix a size of conductor on account of considerations of the economical construction of the cable—that

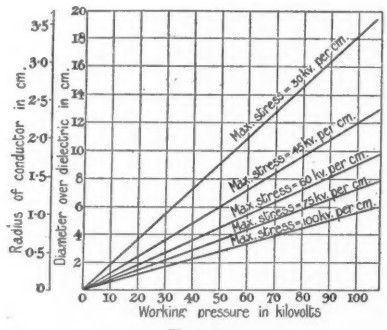

Radius of conductor in cm.
Diameter over dielectric in cm.
Working pressure in kilovolts
Max. stress = 30kv. per cm.
Max. stress = 40kv. per cm.
Max. stress = 50 kv. per cm.
Max. stress = 75kv. per cm.
Max. stress = 100kv. per cm.

Fig. 1.

is to say, a cable required for these working pressures has, in order to keep dielectric thicknesses within practicable limits, to be designed so that the conductor radius, r, is proportioned to the maximum stress permissible in the dielectric, according to the formula $r = V/S$, where V is the working voltage, and S the maximum stress permitted in the dielectric. It is at these working pressures, therefore, that the factors of character and curvature of conductor surface, and dielectric properties of the insulating material, become of paramount importance, and that any grading device which will tend to keep down the potential gradient must and will be eagerly sought after.

Let us first consider the curvature and character of the conductor surface. Conductors would invariably be made in hollow form to a radius determined by the above-mentioned formula.

The most economical radius of conductor for a given working voltage at a given maximum stress is shown in fig. 1. The scale of "diameter over dielectric" refers to single cable. As the radius of conductor, r, is the most economical for each condition of working voltage and maximum stress, the radius, R, over the dielectric is equal to $r\epsilon$, where ϵ is the base of Naperian logarithms, = 2.718.

Fig. 2 shows a further aspect, *i.e.*, the bearing of the radius of the conductor on the breakdown pressure for given thicknesses of dielectric, assuming 200 kilovolts per cm. to be the

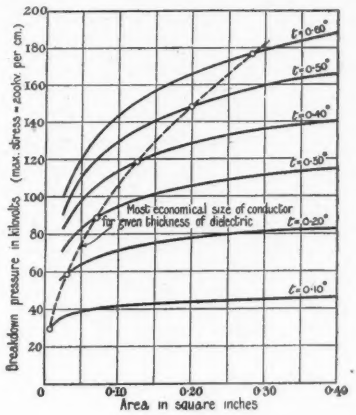


FIG. 2.

maximum stress that the dielectric is capable of supporting.

The proposal, first made, the author thinks, by Dr. Borel, to "lead sheath" the conductor, had the advantage of being a very practical method from the cable point of view, because the attainment of a smooth surface, for instance by means of copper conductors in strip form, is not only difficult but entails risks of greatly enhanced stresses in case of displacement of the strips under the exigencies of handling and bending the cable. Jona used this lead-sheathing method in his graded cable, and calculated that by doing so he obtained a reduction of 20 to 30 per cent. in the maximum stress on the innermost part of the dielectric.

From the point of view of practical construction, it will be seen that the essentials for very high-pressure cables are a large conductor radius, a smooth surface, and true cylindrical form. To secure the latter, the author prefers to form the hollow core of a substantial lead tube. The other conditions are complied with by stranding the necessary number of copper wires upon the tube, and sheathing over them with a thin wall of lead.

Fig. 3 shows the dimensions of a conductor designed on these lines for a 50-kilovolt cable, allowing for a maximum

FIG 3.

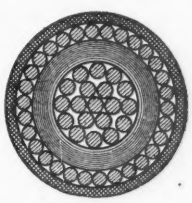


FIG. 4.

FIG. 3.

Inner lead tube	0.256 in. bore, 0.140 in. radial.
Conductor	24/0.082 in.
Outer lead sheath	0.05 in. radial.
Complete diameter	0.80 in.

FIG. 4.

Inner conductor	19/15 S.W.G.
Paper layer	0.117 in. radial.
Conductor	30/0.053 in.
Outer lead	0.05 in. radial.
Complete diameter	0.80 in.

stress in the dielectric of 50 (R.M.S.) kilovolts per cm.

Fig. 4—comparable with fig. 3—illustrates the useful fact that under these conditions of large conductor diameter the embodiment of the split-conductor arrangement now largely used in E.H.T. cables in connection with Merz-Price protection gear does not entail any increase in the overall dimensions of the cable.

Turning to the matter of dielectric properties, the question naturally arises as to how far the proposals of O'Gorman and Jona as to varying the composition of the layers in order to obtain a series of capacities of the required values are practicable from the cable-manufacturing point of view.

Some degree of variation of specific inductive capacity could be brought about with pure papers (free from loading matter) by varying their fibrous composition, without interfering with their dielectric strength or impregnation, the difference between linen, manila, jute, and wood-pulp papers due to their composition and structure being appreciable. It is doubtful, however, whether sufficient variation could be obtained for the purpose by this means alone, or even by varying the composition of the impregnating compound at the same time.

Similarly in Jona's cable shown at the St. Louis Exhibition in 1904, and at the Milan Exhibition in 1906, the adjustment of the capacity by loading the layers of vulcanized rubber must affect the dielectric strength and therefore limit the breakdown value of the dielectric to that of the layer having the highest specific inductive capacity.

From the cable-manufacturing point of view the simplest and most reliable method of grading is by what may be described as the intermediate-sheath method of potential distribution, which consists of the interposition of metallic layers in the wall of the dielectric and of "anchoring" them at suitable predetermined potentials. This method relieves the situation from manufacturing complications because it is much easier to ensure a high and uniform standard of dielectric strength than to control suitable capacity grading.

The majority of large cable users would be more inclined to pin their faith to a single dielectric material with a fully proved history as regards durability, than to a combination of materials. Another practical point of vital interest to large users would be the question of jointing, which would obviously be much more difficult in cables graded by varying materials than in cables having a single dielectric material graded by intermediate sheaths. An incidental advantage of this type of grading is that the electrostatic discontinuity difficulty, which is liable to occur between layers of materials of different specific inductive capacities, is minimised. In the author's opinion the effect of the consequent distortion of the electrostatic field due to imperfect contacts between conductors and dielectrics is of such practical importance that he has proposed to use metallized paper layers—the metal coating being next to the conductors—in order to minimise such effects.

The author prefers the inter-sheaths to be in the form of a lead tube, which enables a close fit to the dielectric to be uniformly maintained and presents smooth surfaces. In most cases the minimum practicable thicknesses of such sheaths will easily carry the charging current. This construction gives the important advantage, from the point of view of efficient manufacture, that the cable may be thoroughly tested after each intermediate sheath is applied, and also between sheaths in the completed state. It will be appreciated that this feature is a very satisfactory one from the purchaser's point of view also.

Various methods of accomplishing the necessary distribution and anchoring of potential for both continuous-current and alternating-current cables have been patented by Tanner and Claremont. One method, by adding suitable external capacities in the form of condensers connected between the potential-distributing sheaths, was patented by the Land and Sea Cable Co.

Professor J. T. Morris suggested inter-sheaths connected to transformer tapping points; an arrangement on similar lines applied to the windings of high-voltage machines was patented by the British Thomson-Houston Co. in 1907.

Another well-known instance of a somewhat similar type of grading is found in the condenser type of terminal now largely used in high-voltage transformers. In this case the capacities of the various layers (forming condensers) are adjustable by trimming back the tinfoil layers to the required extent, this adjustment being sufficient in such short conductors approximately to equalise the potential gradient.

These methods entail the disadvantage from the user's point of view, that they require modifications or additions to the apparatus to which they are connected. It is clear, therefore, that from the commercial aspect it is desirable to keep down the number of inter-sheaths, so that the saving on the cost of the cable due to the method of grading shall not be counterbalanced by the cost of modifications to the connected plant.

With this aspect in view it is interesting to take the concrete example of a 75-kilovolt alternating-current single cable and to examine the effect of using one or more potential distributing layers under given conditions of maximum stress, say 45 (R.M.S.) kilovolts per cm.

(To be continued.)

DISCUSSION.

Dr. ALEX. RUSSELL, in opening the discussion, said he believed this was the first paper on cables before the Institution by a man engaged in the manufacture of them. The author had described many novel phenomena and new methods of manufacture; incidentally the paper proved that rule-of-thumb methods were no longer popular. He was most interested in the inter-sheath method of grading; distinct economies could be effected with this method of construction for high voltages. While formerly he had recommended the Jona method, he was now convinced that the inter-sheath was much the better solution. Users were not prepared to admit that the specific inductive capacity would remain constant throughout the life of a cable with graded insulation. They would expect capacity currents with inter-sheaths and it was obvious that the capacity between the inter-sheath and lead-sheath was much larger than the original capacity of the cable. The function of the capacity currents was to level down stresses in the dielectric.

For longer lengths than ten miles possibly some method would be adopted for feeding the capacity current in at certain points and the sheathing would be suitably modified, but for very long cables some other method must be found. This type of construction was quite suited for long lengths of direct-current cable as used in the Thury system.

Mr. E. H. RAYNER thought that the use of a central lead tube in the inter-sheath cable appeared to be expensive, and it might be possible to use a paper core. He asked whether any single cable of the type described had been used practically. It seemed there might be a difficulty in the use of potential dividers. During the last few months useful results had been obtained by the method of superposing direct current on alternating current in breakdown tests on paper cables. The author gave no definition of the properties of insulating materials used for high-voltage cables.

Mr. P. V. HUNTER said the paper might be taken as recommending single-core cable for E.H.T. work, and, though he agreed with the author largely, he did not think it would be possible to supersede the present three-core cable system for general transmission purposes; where the pressure was too high, the single-core inter-sheath cable would be useful. With very high voltages it was evident that a large amount of energy had to be transmitted, and in that case a large radius would be attained. It would be necessary to take steps to meet reactance and capacity effects with single-core cables, and he feared that at times something more than working voltage would be impressed on the inter-sheath due to surges, and this would have to be provided for.

Prof. SCHWARTZ said insulating material should possess recognised mechanical, physical and electrical properties, which should be maintained over a number of years. It was possible to forecast the life of these properties by mechanical and physical tests, the latter indicating the degree of permanence of the electrical properties. So far as the natural deterioration of rubber was concerned, plantation smoked sheet compared well with fine Para, and had already reached a stage which the author had expected to be reached in the future.

Mr. F. C. RAPHAEL dealt at some length with the question of breakdown of inter-sheath cables and the difficulties of testing such cables.

Mr. J. H. C. BROOKING pointed out that while the author had discussed the insulation of cables he had not touched on the protection of them, although this was becoming more and more important. Much trouble arose from the effect of vibration on lead sheathing—more than would be credited.

Mr. C. P. SPARKS, referring to the author's description of a 3-core cable joint with porcelain spacers, said he much preferred an ordinary carefully made joint with the insulation reinforced. The National Physical Laboratory had carried out exhaustive tests on temperature rise and fixed a very low limit. He asked what did the author consider the upper safe limit of temperature rise. He totally disagreed with the author's remarks on bitumen cable, which had proved treacherous in the past, and should only be used in special circumstances.

Prof. MORRIS drew attention to the peculiar movements shown by the author's cable expansion diagrams, especially as regarded the free ends. Lead-sheathing appeared to make a concertina movement with regard to the copper core, and he thought it might be possible to introduce some method of mechanically coupling them. He had some years ago concluded that inter-sheath cables might be of use, and with the Thury system it would be possible, by coupling the sheaths to intermediate terminals of the series of generators, to maintain the potentials at the desired amounts.

Mr. C. H. WORDINGHAM said it had not been recognised how very important was the question of tinning in rubber cables. They were also ignorant as regarded the damaging effects on dielectrics of temperature.

Mr. MELSOM disagreed as to the accuracy of the curves showing temperature rise in cables, especially such curves as were supposed to be derived from his and Mr. Booth's formula. There was a tremendous difference between the author's curves and any others published. The above formula applied to wiring in houses, and not to buried cable: he also pointed out that no data was given as regards the cables referred to.

Mr. BEAVER, in replying, said he thought inter-sheathed cables would be used to connect up to overhead lines. It would be necessary to fix the voltage of the sheaths by tapping transformers, and for direct-current, resistances or tappings from generators in series might be employed. He did not wish it to be thought that he suggested the use of single-core cables until the 3-core type became too bulky. It was no good having intermediate sheaths unless there were some terminals to connect up to, and so it would be necessary to have the co-operation of the manufacturers in their use.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,872. "Wireless or radio-telegraphy." C. HORTON. November 2nd.

21,881. "Machine for winding electro-magnetic coils." C. H. THORDARSON. November 2nd. (Complete.)

21,891. "Electrical conductors." BRITISH THOMSON-HOUSTON Co., LTD. November 2nd. (General Electric Co., United States.)

21,895. "High-tension discharge apparatus." H. R. RIVERS-MOORE. November 2nd.

21,901. "Dynamo-electric machines." W. A. PRICE. November 2nd.

21,904. "Telephone-call registering devices." V. THOMPSON. November 2nd. (Complete.)

21,906. "Reversible connector for electrical apparatus." W. A. S. BENSON & Co., LTD., and E. ELWOOD. November 3rd. (Complete.)

21,921. "Loud-speaking telephone apparatus." H. J. C. FORRESTER. November 3rd. (International Callophone Corporation, United States.) (Complete.)

21,925. "System of electrical wiring for buildings." D. S. MUNRO. November 3rd.

21,936. "Electrical relay apparatus." C. B. BURDON. November 3rd. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

21,939. "Automatic device for the operation of electric switchgear. H. V. JAMES. November 3rd.

21,953. "Telegraphic systems." E. A. GRAHAM. November 3rd.

21,955. "Inter-communication telephone systems." W. BLOGG & STERLING TELEPHONE & ELECTRIC Co., LTD. November 3rd. (Complete.)

21,966. "Distributors for electrical generators." C. T. MASON. November 3rd. (Divided application on 29,655/13. December 23rd.) (Complete.)

21,968. "Miners' electric safety lamps." J. G. PATTERSON. November 3rd. (Divided application on 25,210/13, November 5th.) (Complete.)

21,978. "Electrical switches." MIDLAND MANUFACTURING Co., LTD., & W. BARBER. November 4th.

21,992. "System of self-actingly switching-off defective sections of electric distributing nets." M. HOCHSTADTER. November 4th. (Convention date, November 5th, 1913, Germany.) (Complete.)

21,998. "Electrical switches." H. LEITNER. November 4th.

22,016. "Handles particularly adapted for electric switch levers and also applicable to other instruments." F. R. WADE. November 4th.

22,030. "Miners' oil and electric safety lamp combined." J. T. PRESTWICH. November 5th.

22,042. "Apparatus to control the voltage of electric generators." G. INRIG. November 5th.

22,044. "Dash-pot plungers." ELECTRIC & ORDNANCE ACCESSORIES Co., LTD., and J. ETCHELLS. November 5th.

22,045. "Arrangements for self-actingly switching-off defective sections of electric distributing nets." M. HOCHSTADTER. November 5th. (Complete.)

22,047. "Electric advertising devices and signs." F. C. REILLY. November 5th. (Complete.)

22,057. "Manufacture of tungsten filaments for electric incandescent lamps." E. R. GROTE & J. W. H. REYNOLDS. November 5th.

22,062. "Electric generators for lighting mechanically-propelled vehicles." H. C. H. SMYTH. November 5th.

22,113. "Overhead arrangements for use at cross-overs or switches on electric trolley lines." C. B. BURDON. November 6th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

22,119 "Electric cables." W. C. KNIGHT & CALLENDER'S CABLE CONSTRUCTION Co., LTD. November 6th.

22,131. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD. November 6th. (General Electric Co., United States.)

22,133. "Self-induction coils for use in duplex or multiplex telephone connections." A. H. OLSSON & H. B. M. PLEIJEL. November 6th. (Convention date, November 7th, 1913, Sweden.) (Complete.)

22,134. "Signalling." R. A. FESSENDEN. November 6th. (Convention date, January 10th, 1914, United States.) (Complete.)

22,150. "Electric water-heater." J. F. WHEELOCK. November 6th. (Complete.)

22,154. "Electric-lamp holders." W. D. FOX. November 7th.

22,174. "Electrical switchgear." T. MILLS & SPENCER & Co., LTD. November 7th.

22,176. "Mounting indicating-instruments in switchboards, more particularly used on motor-cars and other vehicles." C. A. VANDERVELL. November 7th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

20,798. PROCESS AND APPARATUS FOR ESTABLISHING SYNCHRONISATION BY MEANS OF ELECTRIC WAVES. M. P. Otto. September 15th. (September 16th, 1912.)

22,157. TELEPHONE TRANSMITTING APPARATUS. A. H. Foote. October 1st.

23,332. ELECTRIC RELAY. W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. October 15th.

23,342. TERMINALS FOR HIGH-TENSION ELECTRIC APPARATUS. F. Coates & A. Reyrolle & Co. October 15th.

23,565. TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). October 17th.

23,601. CAPS OR MOUTHPIECES FOR TELEPHONIC TRANSMITTERS AND OTHER SOUND INSTRUMENTS. A. Marr. October 18th. (Cognate application 24,525/13.)

24,755. MEANS FOR USE IN THE MANUFACTURE OF TELEGRAPH AND LIKE INSULATORS. F. Hancock. October 31st.

27,660. PROTECTION OF ELECTRICAL DISTRIBUTING OR CURRENT-CARRYING SYSTEMS. H. W. Clothier & A. Reyrolle & Co. December 1st.

27,905. TELEPHONE SWITCHING MECHANISM. M. S. Conner. December 4th.

28,415. APPARATUS FOR THE PRODUCTION OF ELECTRICITY FOR USE IN THE TREATMENT OF BIRDS AND ANIMALS. T. T. Baker. December 9th.

28,499. ELECTRIC IGNITION OF GAS-BURNERS. E. Plumstead. December 10th. (January 26th, 1914.)

28,554. WATER PRESSURE, AIR LEAKAGE, AND AIR PRESSURE INDICATORS. C. W. Thompson. December 11th.

1914.

1,143. SUPPORTS FOR ELECTRICAL CONDUCTORS OR OTHER PURPOSES. Callender's Cable & Construction Co., C. W. Kay. January 15th.

2,499. SPARKING PLUGS FOR EXPLOSION ENGINES. C. Spada. January 30th. (April 1st, 1913.)

5,542. PROTECTIVE DEVICES FOR ELECTRIC DISTRIBUTION SYSTEMS. E. E. Creighton. March 4th. (March 19th, 1913.)

9,092. ELECTRIC RELAY APPARATUS FOR TELEPHONIC AND OTHER VARIABLE CURRENTS. H. de Forest Arnold. April 9th. (Addition to 29,384/12.)

15,324. APPARATUS FOR ELECTRICALLY IGNITING MINERS' SAFETY LAMPS. V. E. Joyces and Spagnoletti, Ltd. June 26th.

17,603. APPARATUS FOR ELECTROCUTING ANIMALS. E. G. Fairholme & A. D. Clarke. July 24th.